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CONTENTS—NOVEMBER, 1931

VOLUME XII, No. 11

ORIGINAL ARTICLES

Energy Distribution in the Irradiation of the Human Body with Ultraviolet Rays from Various Artificial Sources.....	J. Severy Hibben, M.D.	645
The Physiological Background of Muscle Re-Education.....	Arthur Steindler, M.D., F.A.C.S.	655
Treatment of Sciatica by Physical Measures.....	Norman Edwin Titus, M.D.	662
The Anti-Phlogistic Action of Infrared Rays.....	G. J. Warnhuis, M.D.	665
A Consideration of Some Terms of Physical Therapy in Otolaryngology.....	George B. Rice, M.D., F.A.C.S.	668
The Treatment of Deafness by the Zünd-Burguet Electro-Phonoide Method: Summary of Forty Consecutive Cases.....	R. Graham Brown, F.C.S.A.	671

EDITORIALS

"Cold-Quartz"	675
Advances in Electrosurgery	677

SPECIAL SECTIONS

Queries and Clinical Notes.....	679
Physical Therapy in the Modern Hospital.....	689

CURRENT NEWS AND SCIENCE

Miscellaneous Items of Interest.....	681
--------------------------------------	-----

THE STUDENT'S LIBRARY

Book Reviews	691
--------------------	-----

INTERNATIONAL ABSTRACTS

Abstracts of Articles on Physical Therapy, X-Ray, Radium, Biophysics and Allied Subjects.....	694
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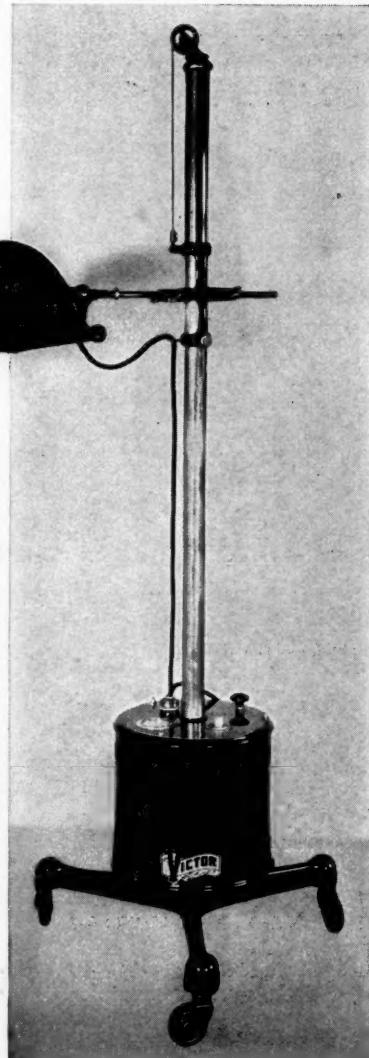
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ENERGY DISTRIBUTION IN THE IRRADIATION OF THE HUMAN BODY WITH ULTRAVIOLET RAYS FROM VARIOUS ARTIFICIAL SOURCES *

J. SEVERY HIBBEN, M.D.

PASADENA, CALIFORNIA

In a report presented by Hibben and Loughridge, before the ninth annual session (September, 1930) of the American Congress of Physical Therapy, data were submitted regarding the energy output of certain standard ultraviolet generators available for therapeutic purposes.

The problem has been undertaken for the purpose of evaluating the comparative emanations of each lamp and for fixing a standard dosage which could be utilized in practical administration. It was planned to measure the photo-chemical energy values and to establish more definitely their preventive and corrective therapeutic resources.

The data of the first report were the results of an attempt to establish along certain lines, comparison measurements of the actinic radiations of artificial energy sources from the following types of lamps:

- I. Direct current, water-cooled, mercury arc in quartz lamp;
- II. Direct current, air-cooled, mercury arc in quartz lamp;
- III. Cold-Quartz grid body lamp;
- IV. Cold-Quartz orifice lamp;
- V. Alternating current, air-cooled, mercury arc in quartz lamp.

A casual examination of the foregoing list of lamps is sufficient to indicate that, however complete in respect to particular details our data may have been these data as a whole were fragmentary. For example, they did not include the alternating current water-cooled lamp, nor did they deal with the matter of energy distribution from water-cooled, mercury arc in quartz lamps as radiated through quartz applicators.

The preliminary investigation was in many respects incomplete due to the pressure of time and the lack of opportunity. The data were submitted in their incomplete form as representing part of an undertaking which it was hoped might be fully completed within

the ensuing year.

Despite the loss of Dr. Loughridge's collaboration due to his assumption of other responsibilities, it was decided to complete the original problem with other assistance. The additional data gathered during the past year are far from complete and by no means as comprehensive as desired. They represent, however, a series of observations considerably larger and more intensive than those originally outlined.

In the original investigation the object was to establish a practical unit of measurement of aid to the average practitioner employing ultraviolet radiation. We endeavored to measure, to reproduce, and to establish dosage of uniform value, no matter what type of lamp was used. After the clinician has determined what therapeutic agent he shall employ, the physician has then to determine the quantity of the energy to be prescribed and the location of its application. It is not sufficient that he should know merely *what* to administer. He should also know the correct answers to the questions, "How much?" and "Where?"

From the standpoint of the physician, our study divided itself in determining two fundamental aspects of ultraviolet energy, namely, (1) Quantity, and (2) Distribution in relation to the types of ultraviolet lamps enumerated above.

The Quantitative Factor

Quantity of energy is encountered as a combination of two factors, intensity and time. Varying as it does in a ratio inversely proportional to the square of the distance between the source and the incidence of radiant energy, intensity is a factor that greatly complicates the question of quantity wherever changes occur in the angle of incidence, or in the distance of ultraviolet radiation. If the course of radiant energy is point-shaped, or arc-shaped, and operated in a fixed position in relation to a plane area relatively extended, the entire area of the plane irradiated repre-

* Read at the Tenth Annual Meeting, American Congress of Physical Therapy, Omaha, Nebraska, October 7, 1931.

sents a variation in the angle of incidence, except for a small spot the exact size and shape of the opposing plane of the source.

In dealing with the arc sources of energy, and relatively small irradiated areas, the Burt Photometer proved to be satisfactory for rapidly calculating incident intensity. The Burt Photometer provides a means of evaluating the energies of a quartz-mercury arc from zero to maximum, as radiated along a line running parallel to the arc, and along a line running at right angles therewith, on a plane opposed to the lamp. I believe that there should be a Burt's distribution measurement system in conjunction with every quartz-mercury arc that is used for therapeutic radiation of the body.

The present work was impeded not only by loss of Dr. Loughridge's collaboration, but also by the fact that previous results had been altered by improvements which a manufacturer had made in one of the ultraviolet lamps employed in our first investigation. Much of our work, therefore, had to be done over. The changes made in the characteristics of the apparatus threw out of line all the data of other lamp radiations gathered in comparison tests that had included the obsolescent lamp. Thus the energies of the lamps originally measured in tests with the changed lamps had also to be measured again.

The present report for the most part, is based on the work of Professors Warner and Morandini, of the University of California, and of Professors Mackeown and Bowen of the California Institute of Technology.

Photometric tests of intensity of ultraviolet energy radiated by various therapeutic lamps were conducted by Professors Warner and Morandini. The work of these physicists has extended well on toward completion in the field of quartz-mercury lamp apparatus. Their findings have been reduced to graphia, in the form of proportional square area charts, and to mathematical terms of percentage.

Although our photometric measurement of energies delivered by quartz-mercury irradiation lamps has not yet been concluded, photometric comparison measurement of energies delivered by quartz mercury cavity irradiation lamps is fairly comprehensive.

Results

In the various tabulations of results of the photometric tests of the intensity of ultra-

violet energy radiated by various therapeutic lamps, the total ultraviolet radiation of the lamp which registers the greatest intensity through the media described, is taken as 100 per cent, and the total ultraviolet energy of each other lamp in the same series is described in terms of percentage proportion.

Series A

In the first series, the intensity of ultraviolet energy of the following lamps was compared:

- I. Direct current, water-cooled, mercury arc in quartz lamp through Sampson pyorrhea quartz rod applicators;
- II. Alternating current, water-cooled, mercury arc in quartz lamp through Sampson pyorrhea quartz rod applicators;
- III. Cold-quartz oral orifice lamp.

The results of tests made in this series, which can be seen graphically by referring to Figure I,* may be tabulated as follows:

1. Direct current, water-cooled, mercury arc in quartz, through end of Sampson straight quartz rod pyorrhea applicator.....100.00 per cent.
2. Direct current, water-cooled, mercury arc in quartz, through end of Sampson bent quartz rod pyorrhea applicator.....60.76 per cent.
3. Alternating current, water-cooled, mercury arc in quartz, through end of Sampson bent quartz rod pyorrhea applicator.....11.12 per cent.
4. Alternating current, water-cooled, mercury arc in quartz, through end of Sampson straight quartz rod pyorrhea applicator.....17.42 per cent.
5. Cold-quartz orifice lamp, through dental cold-quartz tube.....64.03 per cent.

It is to be noted that the side emission from the applicators as described in 1, 2, 3, 4 of Series A was found negligible.

Series B

In the second series, the intensity of ultraviolet of the following type lamps was compared:

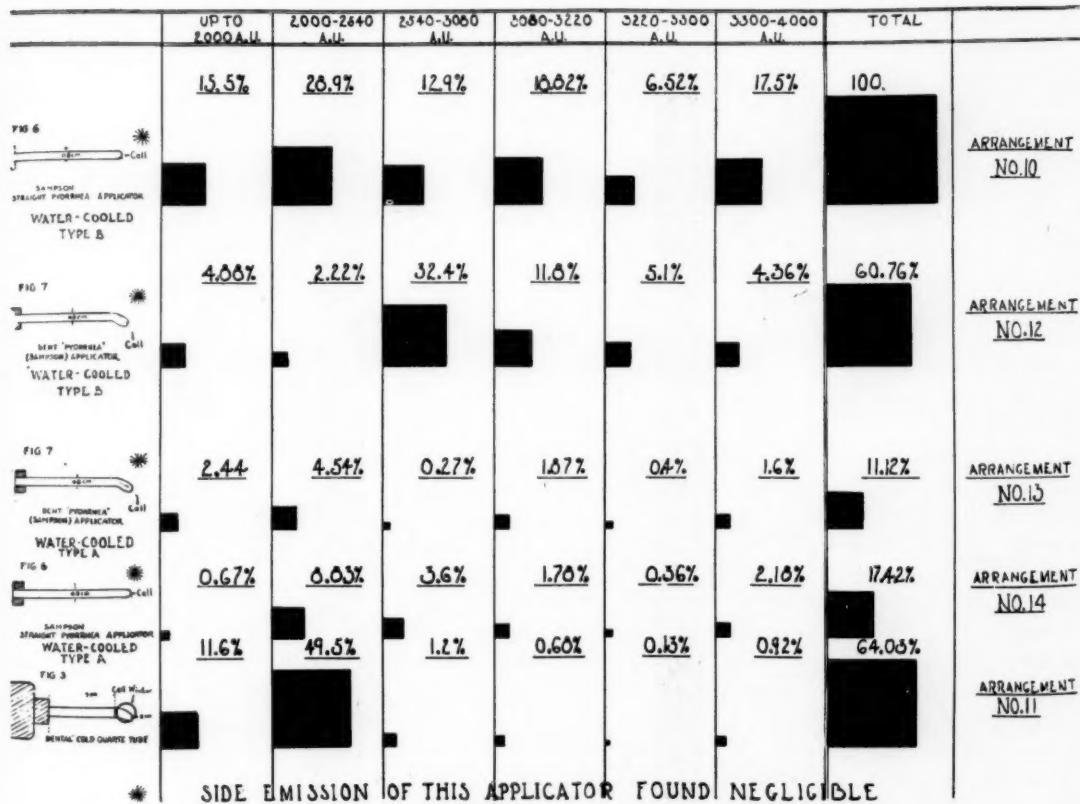
- I. Direct current, water-cooled, mercury arc in quartz lamp;
- II. Alternating current, water-cooled, mercury arc in quartz lamp;
- III. Cold-Quartz Universal lamp, pharyngeal-nasal model.

By referring to Figure III, the following tabulated results are shown in graphic form:

1. Cold - Quartz Universal lamp,

* Tests and Charts as shown in Figures I-V, inclusive were prepared by A. H. Warner and D. M. Morandini, Physicists, University of California, Los Angeles.

FIG. I



End emission of various quartz applicators and percentage of energy transmission according to wavelengths.

through "universal" cold quartz tube, side emission, taken at a point about half the length of the applicator.....100.00 per cent.
 2. Cold - Quartz Universal lamp, through "universal" cold quartz tube, side emission, taken at the end of the applicator.....78.66 per cent.
 3. Alternating current, water-cooled, mercury arc in quartz, through end of bent quartz rod, hay fever applicator (bubbled and flattened end).7.71 per cent.
 4. Direct current, water-cooled, mercury arc in quartz, through end of bent quartz rod, hay fever applicator, through same applicator as in No. 3.....47.47 per cent.

The side emission from the applicator as described in 3 and 4, Series B, was found to be less than 1 per cent, or negligible.

Series C

In the third series, the intensity of ultraviolet of the following type lamps was compared:

1. Direct current, water-cooled, mercury arc in quartz lamp;

II. Alternating current, water-cooled mercury arc in quartz lamp;

III. Cold-Quartz Urethral lamp.

The results of tests made in Series C are as follows: (See Figures IV, and V.)

1. Cold-Quartz Urethral lamp, through cold-quartz urethral tube, side emission, at a point about half the length of applicator.....100.00 per cent.
2. Cold-Quartz Urethral lamp, through cold-quartz urethral tube, side emission, taken at the end of the applicator.....61-78 per cent.
3. Direct current, water-cooled, mercury arc in quartz, urethral rod applicator, side emission from point at bubbled area (See Fig. IV).....0.43 per cent.
4. Direct current, water-cooled, mercury arc in quartz, urethral rod applicator, emission taken at end of applicator.....4.37 per cent.
5. Alternating current, water-cooled, mercury arc in quartz, urethral rod applicator, emission taken at end of applicator.....1.06 per cent.
6. Alternating current, water-cooled, mercury arc in quartz, urethral rod applicator, emission taken from point of

FIG. II

Spectrum A
Current 15 m. a.
Exposure 30 sec.

1849

1942

1973

2028

2053

2536

3128

3657

4358

Spectrum B
Current 4 m. a.
Exposure 2 min.

1849

1942

1973

2028

2053

2536

3128

3657

4358

Ultraviolet spectra emission through a Cold-Quartz orificial lamp (No. 01098).

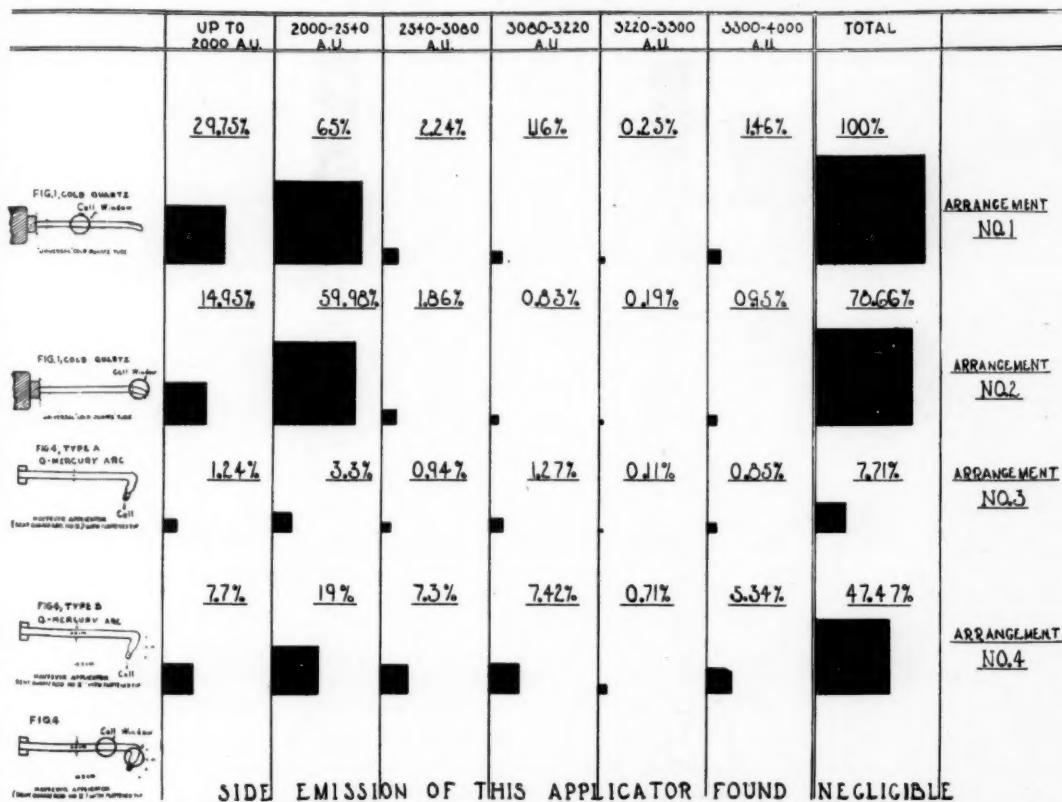
bubbled area. (See Fig. V.).....
.....0.41 per cent.

From the foregoing data it is noted that as compared with lamps which deliver ultraviolet energy through quartz rod applicators, the Cold-Quartz lamps are different and represent a new innovation in ultraviolet radiation. Whereas ultraviolet energy radiated through quartz rods is distributed in one direction, namely from the end of the applicator, the ultraviolet energy of a Cold-Quartz lamp is distributed in a radically different manner. The ultraviolet energy radiated from a Cold-Quartz orifice lamp is radiated in all directions in such a manner that when the tube is operated in a cavity, its radiations strike the cavity side-walls relatively at right angles.

We come now to the matter of ultraviolet energy distribution over the body. As we compare various types of mercury arc in

quartz lamps, we find in the Cold-Quartz whole body irradiation lamp, structural peculiarities which place it outside the scope of certain mathematical laws that prevail over the radiations of arc sources of ultraviolet energy. For example, the Cold-Quartz Grid in body irradiation presents no complexities in the form of intensity gradation along a plane extending from the waist line to the feet and the shoulders — there is nothing to resemble the mathematical problems presented in the distribution of energy over the body that occur when the body is irradiated from an arc source of ultraviolet energy. When Cold-Quartz whole body irradiation is employed, intensity at the ends of the body and at intermediate points is the same as ultraviolet intensity at the waistline. The reason for this is that the lamp is made to be operated in motion, and is operated at a fixed distance

FIG. III



End and side emissions of various quartz applicators and percentage of energy transmission according to wavelengths.

from the body, on fixed planes, and at a fixed rate of motion.

Another structural peculiarity of far reaching import appearing in the Cold-Quartz whole-body irradiation lamp is this: Whereas all arc sources of ultraviolet radiation are relatively point-shaped, and short-line-shaped, the Cold-Quartz lamp is relatively a broad source of radiation, with an area many times greater than that of an arc radiation source. (See Fig. VII upper chart.)

Obviously, the photo-electric cell window, however well adapted it may be to measuring energy radiated from a source smaller in area than itself, was not adapted to measuring, in like manner, the energies of a source of radiation many times greater in area than itself. Some method, other than that depending on the photo-electric cell, must be employed if results for intelligent comparison of energy sources were to be secured.

Recourse for solution of the problem was had by cooperation of the chemical engineering concern, Smith-Emery & Company, of

Los Angeles and San Francisco. Tests of ultraviolet energy emission were made by them in accordance with the nitrate-nitrite formula for absolute, as well as comparison, measurements of the radiations of artificial ultraviolet energy sources.

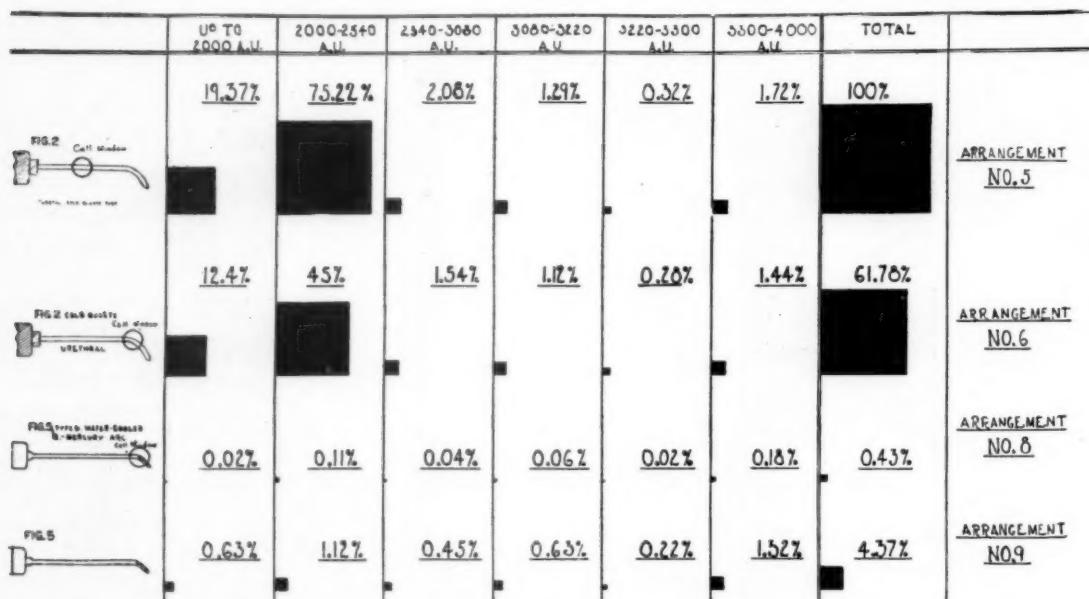
Simulating the distance and the conditions of lamp operation that obtain in therapeutic radiation of the body, nitrate-nitrite ultraviolet energy tests were made as follows:

1. Direct current, air-cooled, mercury arc, body irradiation lamp.
2. Alternating current, air-cooled, mercury arc, body irradiation lamp.
3. Cold-Quartz grid, whole-body irradiation lamp.

The results of the comparison tests have been represented by graphia in the form of proportional square areas, showing the number of milligrams of nitrite produced from nitrate by the respective lamps.

By the Cold-Quartz grid, whole-body irradiation, lamp:

FIG. IV



End and side emissions of various quartz applicators and percentage of energy transmission according to wavelength.

The total ultraviolet energy delivered, in a given time, to an area of 433.7 square centimeters, at the distance prevailing in therapeutic body irradiation, namely five inches, is indicated by the proportional number, 945. (Fig. VIII, No. 1.)

By the direct current, mercury arc, body lamp:

The total ultraviolet energy delivered in the same time, to the same area, at a distance of ten inches (the closest proximity in which this lamp may be used for body irradiation) is indicated by the proportional number, 340.7. (Fig. VIII, No. 2.)

By the alternating current, mercury arc, body lamp:

The total ultraviolet energy delivered, in the same time, to the same area, from a distance of ten inches (the closest proximity in which this lamp may be used for body irradiation) is indicated by the proportional number, 28.66. (Fig. VIII, No. 3.)

In this connection it is to be remembered that the energy represented by the proportional number, 945, in the case of the Cold-Quartz lamp, may in therapeutic practice be delivered to an area of 433.7 square centimeters wherever that area occurs on the body surface as an integral plane.

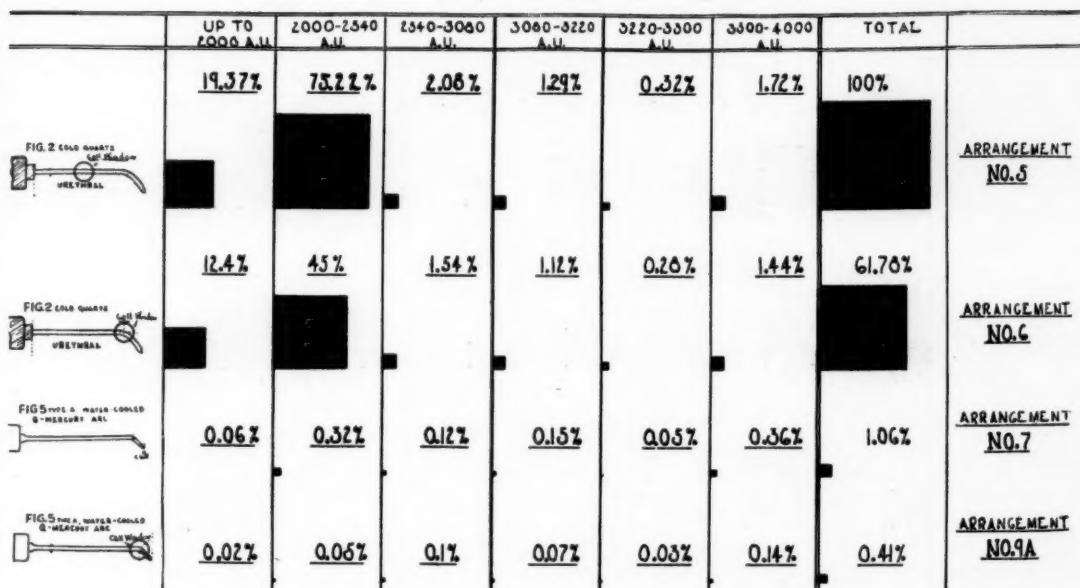
There is yet another question of energy

measurement which I must touch upon before I conclude. It is this: What intensity of energy does an ultraviolet lamp give me today, as compared with the energy it gave me yesterday, or a week ago? The purpose of this research is to give the physician something resembling a constant against which he might compute fluctuations of energy owing to deterioration in the energy source, as well as fluctuations of energy such as have been seen often to occur independent of deterioration, and independent of changes in a lamp's electrical input. To report the data of tests of an ultraviolet lamp whose energies are guaranteed by the lamp's manufacturer to remain at a constant level for a period of one year, even though the lamp be operated continuously, and then to compare with it lamps whose energies have a life expectancy of less than 3,000 hours are not seemly things to do. However, at my suggestion, constancy tests were made by Dr. S. S. Mackeown* of the California Institute of Technology. Although I shall report no comparison data of such tests at this time, I quote a few statements from a report which Dr. Mackeown rendered me on October 1, 1931.

Dr. Mackeown says: "The Cold-Quartz

* The author's manuscript is supplemented by original reports from the laboratories where the technical work was performed. These supplementary reports will be included in the author's reprints.

FIG. V



End and side emissions of various quartz applicators and percentage of energy transmission according to wavelength.

grid body lamp was run for a period of 50 hours at a current of 50 milliamperes, which is the current at which these lamps are operated During this run the ultraviolet radiation varied only a few per cent with no tendency to increase or decrease The variations in these readings can be attributed to experimental error It would be reasonable to assume that this constancy would last through practically the whole life of the tube Estimates have been made of the life that could be expected from the Cold-Quartz grid body lamp based on data obtained from two small lamps which have already shown a life in excess of 3000 hours at a 100 milliampere current, and a life of 11,000 hours at 15 milliamperes current. Both these small lamps are still burning, and show no appreciable change. It is safe to conclude that a minimum life in excess of 9,000 hours of continuous operation at 50 milliamperes can be expected from the Cold-Quartz grid body lamp. This is not an estimate of the maximum life of the lamp, as there is no reason to believe that the maximum life may not be several times as great as this estimate."

Discussion

Dr. Robert C. Burt, Ph.D. (Pasadena, Calif.): It is with great pleasure that I have read Dr. Hibben's very fine paper, and it is with much satisfaction that I observe the growing tendency

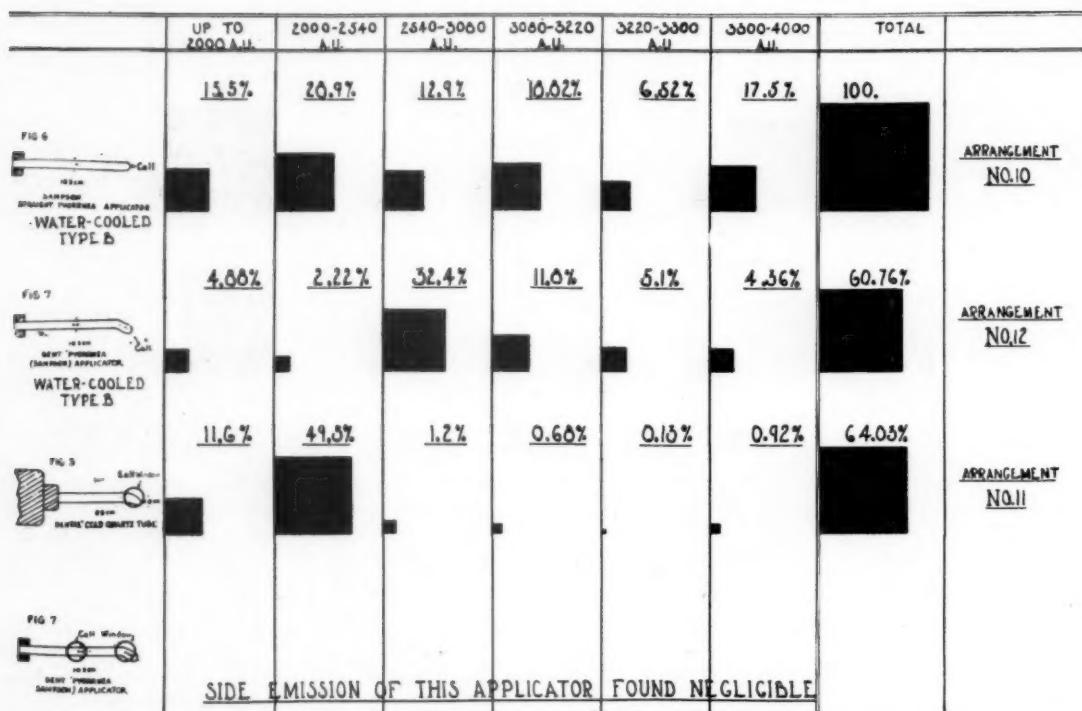
for consultation on scientific and physical things to specialists in this field. Dr. Hibben is to be congratulated upon going to such able council in these problems as Drs. Bowen, MacKeown, Warner and Morandini. And they should be complimented on the able and thorough manner in which they have handled the experimental program.

It has, of course, been gratifying to me to know that instruments of my design though developed in the pioneering stages of ultraviolet measurement are still able to serve a useful purpose in this work. As Dr. Hibben has indicated much work still remains to be done, and while the paper gives answers to many problems it also brings up questions which heretofore have been of little consequence.

It is to be noted that the measurements have been taken on specific lamps and are therefore subject to variations over and above the necessary experimental error of such measurements. But all manufacturers of this type of equipment are doing all in their power to place in the hands of the physician as reliable and standardized product as it is possible for them to do and the variation from lamp to lamp of the same type should under these circumstances be very small indeed.

On the measurements themselves, I can make little comment, because I have not had an opportunity to examine the original reports nor talk to the men since the work was done. I might say that I am surprised to see the alternating current lamps so widely divergent from the same type of lamp when direct current is used. My experience in the ultraviolet as well as visible radiation from these lamps would cause me to delve farther into this.

FIG. VI



End emission of cold-quartz and quartz water-cooled applicators and percentage of energy transmission according to wavelengths.

This paper also does not settle the questions which arise as to energy distribution in various wave lengths which is an extremely important question. Doubtless some day we will find that certain wave lengths are especially desirable for some purposes while other wave lengths will doubtless be needed in other places. We have at present only incomplete information on this subject which seems to indicate that the shorter wave lengths around 2937\AA and shorter are particularly effective as bactericidal agents, while some authorities prefer at present to eliminate these wave lengths in ultraviolet when used for general purposes. In this connection, it may be noted that very little energy from the sun is able to penetrate through the earth's atmosphere in wave lengths shorter than 2900\AA .

Other points to be discussed are the practical ones of operative technique, skill required, time needed, and extent of coverage for different techniques.

May I again congratulate Dr. Hibben and his associates for having extended our field of knowledge in a very illuminating investigation.

Dr. A. Bachem (Chicago, Ill.): I was particularly interested in hearing Dr. Hibben's paper, and I hope that I understood most of it, although it was rather difficult for me to follow those figures on his charts.

I made some measurements on the cold-quartz ultraviolet lamp, more, however, from a purely scientific point of view than from the clinical standpoint.

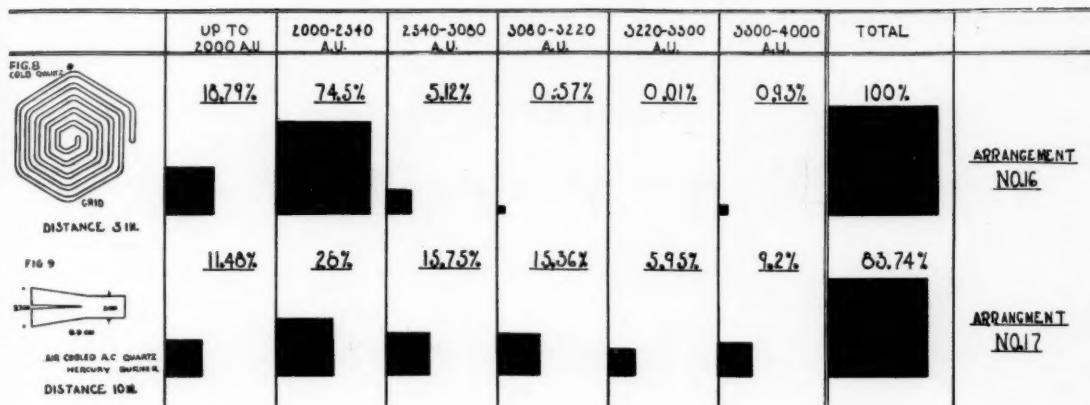
The main advantage for the problem seems to be the monochromatic qualities of this type of lamp, which probably emits the richest wave length at 2587\AA . With a light of such intensity it can easily be regulated or suppressed by filters. This surely is a great advantage. Whether this particular wave length is of value for certain indications still remains to be seen. I must say that it seems to have a great bactericidal and irritative effect. It still has a certain penetrating effect because we know that at 2500\AA there is greater penetration than at 2800\AA , comparing closely to the one at 3000\AA , so it surely penetrates to a certain extent in spite of the fact that it is of such a short-wave length.

I wish we had more types of this kind of lamp for different wave lengths, for instance, 2800\AA for the pronounced antirachitic effect, and perhaps at 3100\AA or 3600\AA for more penetrating effects, deeper reaching effects, and so on.

It seems to me that another great advantage of this type of lamp is that light is produced in a tube inserted into body cavities, while by the older types, for instance, the Kromayer lamp, the light is produced outside and at the point and has to be conducted by a quartz rod into the body cavities. That gives a different distribution. For instance, with the Kromayer lamp we get a point source at the end of the quartz rod, and with this lamp we get a distribution the whole length of the quartz rod.

I do not know the exact intensity comparison between the Kromayer attachment and the cold

FIG. VII



Comparison of energy transmission according to wavelength, using various quartz body irradiation lamps.

quartz lamp. I think the practitioner would be particularly interested in that. I should like to ask Dr. Hibben what he could tell us, for instance, about the erythema time and the comparison between the Kromayer attachment and this hollow quartz rod.

Another great advantage is the constancy of the lamp. I believe that the lamp is so constant that I can do real measuring and standardizing work with it, work that requires close comparison.

There appear to be numerous indications for the use of this lamp, particularly for orificial work, although there, no doubt, are various indications for which the body irradiations also are advantageous.

Dr. N. H. Polmer (New Orleans, La.): I have nothing to add to the discussion, except to ask questions, and the answer to these questions perhaps could not be given without further experimental and clinical observation.

There is perhaps, as has been pointed out, an indication for monochromatic wave bands of light. Just what will a lamp, emitting a constant radiation of 2,537 angstrom units, do for us therapeutically? We have been taught to look for other wave lengths to have more specific effects in rickets. We have been taught to look for shorter wave lengths to have more specific bactericidal properties.

This question deserves further investigation, and I really do not expect Dr. Hibben to answer me until he has the opportunity to make further investigation.

Dr. Disraeli Kobak (Chicago, Ill.): This type of radiation appealed to me in the beginning as a peculiar sort of anomaly in ultraviolet light therapy, and when it was called to my attention I projected a rather negative attitude toward the results.

I recall the first time I experimented with this light. I was told that it could produce an erythema equally as great, equally as efficient, and as promptly as with the older lamps. I was rather skeptical. I was told to bare my arm which I did with great alacrity because I felt

here was a point in proof which would at least deny the claims which were being made.

I promptly forgot about the experiment because in the busy day's work I did not think about it until that night. Something happened to my arm that night. I did not know what it was, but when it came in contact with the hot water in the bath it felt unpleasantly different than the other arm. There were two erythema lines on the flexor surface of that arm as a result of a 30 second and one minute irradiation. I carried those two marks for probably six months. I believe in the course of conversation yesterday, I showed a fading pigmentation line still remaining where the one-minute irradiation took place.

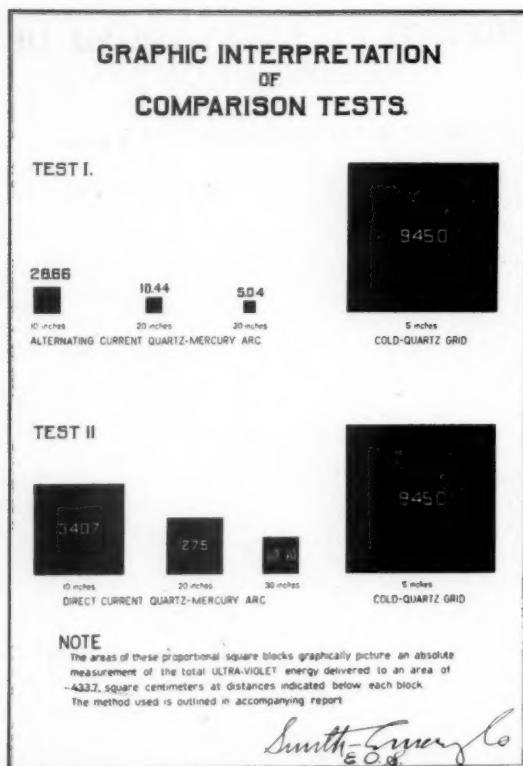
I became interested in the lamp from a therapeutic point of view, and took advantage of the opportunity of studying its effect on clinical patients. I installed one lamp at Rush Medical College and one over at the Cook County Hospital and a third one in my office. The patients were irradiated at various distances in order to observe the erythema reaction and the systemic effect. I found that the shorter distances, from 20 to 5 inches, produced a more prompt skin reaction than the longer ones used with my other lamps. The general effect was the same but I was able to use this lamp at some rather impossible angles.

It also appealed to me that the source of radiation was a constant one, that there was practically no depreciation in the irradiation quality of the lamp. That means much to us as clinicians because we know from experience that many lamps lose their intensity in a relatively short time.

While this is of interest to the clinician who employs a lamp and wants to use it for a long time, it is also of interest to the clinician to know that he can employ this type of lamp for contact application without the intermediary effect of a water cooling device.

I recall from my clinical experience two cases that I shall cite. One was a case of hay fever. He came because of recommendation that I would probably aid him with physical measures.

FIG. VIII



Amount of nitrite, in milligrams produced from nitrate by various quartz body irradiation lamps.

He was both skeptical and cynical and frankly I was also doubtful of my ability to produce convincing results on one so chronic. I used the cold-quartz nasal lamp.

I inserted the orificial quartz applicator into his nose, and I assured him it wouldn't be hot. I kept it in there for a longer period than that advised by those who have used this type of irradiation. They advised thirty to ninety seconds. I used it for three minutes, plus. I am sure it was plus.

I told him he probably wouldn't feel any reaction for the next four hours, but that he might experience an exacerbation of his symptoms within twenty-four hours to be followed by relief. From my experience, under this stimulation there is first an untoward reaction which is later converted into a beneficial effect. When he reported to me later on he said, "I came back here not because I am suffering from hay fever, because I have been completely relieved by the treatment, but because you wanted to be informed of what happened. At ten o'clock I went to sleep. I was sneezing heavily between eight and ten o'clock. After ten o'clock I had a complete night's rest, and since that time I have had no recurrence of the symptoms. I came over here to tell you that."

Another type of case, which probably will answer Professor Bachem's query regarding the clinical value of this apparatus was its use in skin lesions. We had several cases of difficult, chronic psoriasis at the Rush Medical College referred from the dermatologic department. These cases apparently made spectacular improvement—I don't say recoveries—under the administration of cold quartz therapy.

Now it appeals to me if you can get a lamp that maintains its intensity more uniformly, one that is very likely more reasonable in price—a consideration that we as practitioners cannot disregard—together with efficiency equal to that of the other lamps, naturally I, for one, would lean toward apparatuses of that type. I believe much can and should be done in the scientific exploration of this type of apparatus. Its clinical and biophysical nature should be scientifically explored by competent investigation. Such work may demonstrate the limitations or the superiority of this type of ultraviolet radiation. This is much needed at present and should be instituted on as intensive a scale as possible. The present report is to be highly commended as an investigation in the right direction.

THE PHYSIOLOGICAL BACKGROUND OF MUSCLE RE-EDUCATION *

ARTHUR STEINDLER, M.D., F.A.C.S.

IOWA CITY, IOWA

The study of the physiological and physical properties of muscles and of their changes under controlled external conditions has, in the last decade, been a favored field for experimental physiology. Although the investigations of the physical properties of muscles were carried out systematically as early as the 17th century by Borelli, the Italian physiologist, it is only since the discoveries of the modern school of physiology, represented by Sherrington, that the properties of the musculature of the human body have become established to a degree where practical conclusions and concrete application to the problem of muscle re-education could be obtained. Modern physical therapy finds itself in the position which demands that all phases of its activity should first receive the approval of experimental evidence coming from the physiological laboratory. It is not too much to say that many of the practices of physiotherapy, as far as the locomotor apparatus is concerned, are at the present time only based upon an empirical background, and some of them had to go into discard because they could not be indorsed by laboratory experience.

So much seems certain, that the accumulated evidence of physiological facts, pertaining to muscle function, which has come out of the laboratory, has been productive of sound therapeutic application in more than one direction.

Efficiency of the Muscle

All modern muscle physiology stands and falls with Sherrington's "all or nothing law"; that is, the law which states that no single muscle fiber can grade its response. It infers that the gradation of muscular response is caused solely through variation in the number of the contracting elements in activity at any one time. The promptness of this reaction to stimuli, the degree of tension developed by

the activity of the muscle fiber, the duration of the response, and even microscopic changes, are all features for which there exist normal standards; and, by comparison, with normal standards, evidence may be had of pathological conditions. To ascertain these standards a system of recording muscle activity is being used. Mechanical records give information on length and tension; electrical records by showing the difference in electrical potentials, give information as to type, frequency and degree of electrical responses produced by innervation; while chemical records inform us about chemical changes, particularly the combustion processes which lead to and accompany the innervational activity of the muscle. The relative values of all these different properties, physical and physiological, of a given muscle are the basis of the efficiency of the muscle, and we determine its efficiency coefficient by relating its standard values to the amount of mechanical work realized.

On the other hand, by applying the same methods of recording to any pathological situation of the locomotor system, we may, by comparing the individual mechanical, electrical and chemical response records with standard values, arrive at an accurate conception of the functional deficiency in any given pathological condition, and, moreover, the efficiency of our treatment methods may be checked by record control. It stands to reason that, as we recognize the physiological and physical nature of morbid muscle function, such as weakness, fatigue, lack of inhibition or automatism, we are led to a better understanding of what to expect from therapeutic agencies in respect to re-habilitation of the muscle activity. To illustrate this, I wish to select three distinct situations of locomotor disorders. In the first, the muscle is normally efficient but the arrangement of the locomotor complex is, for reasons of extraneous nature, layed out on an uneconomical plan. We observe this in secondary muscular inefficiency;

* Read at the Tenth Annual Meeting of the American Congress of Physical Therapy, Omaha, Nebraska, October 8, 1931.

that is, in the wasteful uneconomic locomotion of the ankylosis joints, of dislocations, of flatfoot, etc. In the second, the muscle function is inherently insufficient, a condition associated with fatigability, exhaustion. In the third, insufficiency rests with lack of innervation control; such as spasticity, incoordination, etc.

I. Normal Muscle— Uneconomic Coordination

The electric response which is intimately connected with the mechanical reaction is expressed by the curve of the action current. The greater the tension of the muscle and the less shortening of the fiber is permitted by the arrangement of the experiment, that is the more the muscle acts under isometric conditions, the higher will be the action current curve. There is also, normally, an interrelation between the mechanical response and the heat production of the muscle during contraction. The most outstanding chemical effect of contraction is the accumulation of lactic acid which involves an increasing demand of oxygen usage in order to burn up lactic acid into its end products—oxygen and carbondioxide. The rate of accumulation of lactic acid during exercise in the normal muscle is known and with it the amount of oxygen necessary for its combustion. We know that in severe exercise the formation of lactic acid may reach the value of 3 g/sec.

From the intake of oxygen and output of carbondioxide, the energy consumed can be established and brought in comparison with the amount of visible work. A ratio of efficiency can then be expressed in terms of relationship between the oxygen expenditure and the amount of realizable work, and so we arrive at a standard of normal efficiency for most of the ordinary occupations, and locomotor acts, including walking, running, etc.

Under pathological conditions we find considerable deviations from the standard efficiency index. For instance in the limp of the bilateral congenital hip dislocation, or the ankylosed hip, so much motion is wasted by the oscillations of the center of gravity, the shifts and tilts of the body, that the ratio between muscular effort and actual work of propulsion is often not one-half of the normal. These cases show the oscillations of the center of gravity during the gait in scoliosis and hip

dislocations. One sees that the oscillations, both upward and sideways, are more than double of the normal. This entails a considerable loss of motion, though not an unnecessary waste, since under the existing handicaps this type of locomotion is the only one to be adopted.

But soon the analysis of the principal muscles would show variations both in the mechanical, electric and chemical responses: less prompt and less forceful contraction curve, an electric response which denotes decrease of muscle tension and inclination to fatigue and a chemical record indicative of spasmodic and intensified muscular efforts.

Now, when the primary causes of the wasteful gait are overcome, for instance, by reduction of the dislocation, it is up to physical therapy to evolve a scheme of locomotion commensurate with the muscle material at hand, which approaches normal function.

A rearrangement of the muscle activity by re-education of the single muscle or muscle group or by changing of the plan of the muscle play is possible and very often practicable. It is the aim of rational muscle re-education to find ways by which the reorganization of the locomotor complexes is effected. This point is still better illustrated in the primary pathological manifestations of the muscular apparatus of which two forms will be discussed: fatigue and spasticity.

II. Pathological Fatigue

From the biochemical point of view, fatigue may be defined as an accumulation of lactic acid to a point at which the normal functional contraction of the muscle fiber is inhibited. Because the removal of the lactic acid by the blood stream is an essential factor in preventing this accumulation, it is above all things necessary in preventing fatigue that the circulation be intact. The blood fed muscle may be stimulated every six seconds indefinitely without fatigue because of the excess of oxygen, the amount of which is raised during the period of recovery sometimes ten to fifteen times its resting value.

This surplus oxygen keeps pace with the production of the lactic acid if no undue accumulation takes place. In moderate exercises there is a steady level of lactic acid, and since oxydation is proportionately increased, also, the oxygen again falls to its normal level. But

in violent exercise the accumulation is more rapid until the fatigue threshold is reached. The excess oxygen intake can take care only of a small part of the lactic acid by oxidation; therefore, after violent exercise, the increase of oxygen keeps on during the resting period, that is, the oxygen debt incurred during the exercise period is paid off during the period of rest. The anatomical site of fatigue is around the endplates of the individual muscle fibers, but the fatigue products may diffuse through the whole muscle.

To understand fatigue, we must remember that prolonged contractions are only made possible by an arrangement of rotational activity of the individual constituents of a group of muscles. According to Sherrington's law, each muscle fiber contracts at maximum. Only by the alternate rotation of the different muscle fiber groups is it possible that a sustained contraction may be obtained. It is interesting from the viewpoint of the practical physiotherapist that there is an innervational factor of fatigue based upon the plurisegmental innervation of the muscle from the spinal cord. When one spinal root is stimulated to exhaustion the muscle still responds perfectly to stimulation of the other; the fatigue products are confined to the group of endplates supplied by the same root. On the other hand, when circulation is obliterated or impeded a diffusion of fatigue products throughout the muscles takes place and complete exhaustion results. Proof of this can be seen, first, in the mechanical response of the muscle, where the contraction curve becomes shorter and the angle of relaxation disappears; and secondly, in the action current curve, where the oscillations become larger but are fewer in number, that is, have a lesser frequency. Of particular interest is the effect of diet upon fatigue. A diet of fat reduces the amount of lactic acid which is produced by contraction; also, the fatigue maximum on electric stimulation is only one-half of that obtained by carbohydrate feeding. Carbohydrates, therefore, are the principal source of muscular energy and subjects fed on fat are much more easily fatigued.

In later years there has been furnished experimental evidence that the sympathetic nervous system has something to do with fatigue. Stimulation of a muscle did not produce the amount of fatigue if during the in-

terval of rest the sympathetic nerves were stimulated, i.e., that the action of the sympathetic retards fatigue, and there is a similarity of effect between the sympathetic and adrenalin. From the practical point of view, it follows that therapeutic efforts to prevent fatigue must be concerned first with an appropriate diet, suitable to supply, with greatest ease, the necessary amount of lactic acid, and also one which keeps the threshold of fatigue high; a diet rich in carbohydrates.

The next point of practical importance is the time necessary for recovery after exercise. The experiments have shown that a muscle twitch every six seconds can be continued indefinitely, as the interval is sufficient enough to dispose of the surplus lactic acid. In all exercise the periods of rest should be commensurate to the periods of exercise to allow a complete removal of the lactic acid before another period of stimulation is instituted. The behavior of the peripheral nerve is of interest. Although the peripheral nerve itself is not fatigable, fatigue through the nerve upon the muscle may be easily produced. It remains localized to the territory of the particular spinal root as long, and only as long, as the circulation of the muscle is intact. From the viewpoint of physiotherapy, therefore, the greatest single local factor to overcome and prevent fatigue is the restitution of the normal circulation of the muscle.

If the mechanical effort is carried beyond the fatigue threshold, we see that the entire mechanism of the electrical response changes. The oscillations become larger and are grouped close together so as to more or less synchronize in form of individual volleys. The impulse becomes discontinuous. The higher controls of movement destroy discontinuity of the impulse and make them more or less continued. Normal electrical responses show smooth and continuous action current curves, which is simply the effect of the alteration or rotation in which single fiber groups are called into action. But, as fatigue appears and increases, there is a corresponding lack of adequate higher control which makes for discontinuity of the action and synchronism. The resulting clonus of fatigue tremor is really caused by the removal of the higher influences. While the nerve trunk itself is infatigable, the higher nerve centers are extremely fatigable and continue to be so until

a block occurs in the neuromotor junction (endplate), suspending function of the muscle fiber altogether.

The pathological fatigability of the muscle is a feature of several types of paralysis. In anterior poliomyelitis the threshold of fatigue is incredibly low, and the state of exhaustion is reached very soon. It seems that in the progressive muscular dystrophies, the fatigue threshold is equally low but recovery takes place more speedily, whereas the recuperation of the fatigued muscle in flaccid paresis is extremely slow; the muscle must be given a much longer period of rest and immobilization. As far as the spastic paralysis is concerned the true contracture positions produce no action current and show no fatigue. The greater, on the other hand, is the innervational fatigability under the effort of voluntary motion. It is of the central nervous type; it has a low threshold and soon reaches the state of fatigue tremor. These are important facts for the physiotherapeutic technic.

III. Tonus and Coordination

From the viewpoint of physiotherapy no phenomenon of locomotive activity is as important as coordination. With the discoveries of Sherrington, we have come to a better conception of this phenomenon. We know that the augmentation of contractile tone never occurs simultaneously in antagonistic muscles, but as contraction in one muscle proceeds relaxation in another muscle takes place *pari passu*. This is the basis of the so-called reciprocal innervation. The mechanism of voluntary contraction can only be understood on the basis of a double reciprocal innervation by assuming that there are two afferent or proprioreceptive nerve reflexes, the one causing flexion contraction and extension relaxation, and the other causing extension contraction and flexion relaxation, respectively, in agonistic and antagonistic groups. Upon this basis we can easily explain the positional innervation and the stabilization mechanism. Now, we know that for the perfect coordination in locomotion the integrity of the higher sense is absolutely necessary, even though the centers in the spinal cord already form the basic plan for locomotion by the simple reciprocal innervation. But when the higher centers come into play simultaneously, by sending out either the excitatory or inhibitory impulses, all these combine in refining the

original spinal reflex movement to the finished product of voluntary motion.

When the simple spinal reflexes present themselves already in asynchronous and continuous action current waves it is so much more the case with the complex movements under control of the higher centers. Can this higher control be secured by re-educational methods? That depends largely upon the localization of the central nervous defects. Postural reflexes and certain automatic movements are taken care of in the spinal cord itself. When the cerebellum is removed, also, the postural reflexes are not essentially altered. But, as one by one the higher centers add their influence, certain modifications to tonus and posture are added (labyrinth, head, neck, eye reflexes, etc.). Finally, when the section occurs upward of the mid-brain, the so-called righting reflexes are included.

From the viewpoint of spasticity we are particularly interested in the rigidity occurring after the removal of the cortex. All these spastic automatic postures are maintained over long periods of time without any fatigue; there is evidently no increase of metabolism. Many separate types of reflexes, however, come from different centers of the brain and converge to produce a common result. Above the thalamus region we find that the attitude of the animal is hardly distinguishable from the normal. We see, therefore, that locomotor disturbances which greatly affect posture or the automatic righting reflexes are not confined to the cortex alone but must involve the deeper centers of the brain.

How can this control of reflex activity be enhanced by physiotherapeutic measures? On the excitatory side we know that tension in the flexor muscles tends to inhibit the reflex activity of the knee jerk. Massage greatly reduces its amplitude. The reflex tone which is exaggerated by spasticity of the effector muscles can be reduced by certain physiotherapeutic measures applied to the antagonist.

Of more importance, however, is the outlook of muscle education in respect to inhibition of the pathologically increased tone. The fact that afferent inhibitory impulses reach the reflex arc from many higher centers offers a tremendous opportunity for circuiting or re-routing of proprioreceptive impulses in

cases where the original routes are closed for inhibitory action, because the paths are destroyed for other pathological reasons. "Long circuiting" is a deflection of impulses to higher centers. For instance, a stimulus eliciting an increased tonus reflex in the spastic, which is not duly inhibited by the higher centers of the cortex because these are destroyed, may receive its inhibition by being long-circuited over another route of lower subcortical centers which are still in function. The whole problem of the muscle re-education of the spastic rests upon the possibility of re-routing the lost inhibitory control over other still intact paths of the central nervous system.

IV. Spastic Paralysis

In this problem of procuring inhibitory influences elsewhere the nature of the reflexes is of importance; some of the reflexes are inborn and hereditary like the knee jerk or the equilibrium reflex, the corneal reflex, the stepping reflex, the vasomotor and sexual reflex. These are much more difficult to control. Others are individual reflexes which have been acquired. (Conditional reflexes of Pavlov.) A new stimulus through any receptor organ which is applied simultaneously with the original may thus be transformed in such a secondary conditioned reflex. The fundamental condition is only that both stimuli, the original one and the added one, be applied simultaneously. In our ordinary locomotion the proprioceptive organs of the muscle are the Golgi bodies which transmit the sensation of tone, the muscle spindles which give the information about position, and the sensory organs transmitting pain. By adding to these secondary reflexes of auditory or visual nature we can make a conditioned reflex out of an unconditioned one, in other words, cause the muscle to respond not only to its original stimulus but to another one which has been added to it, and the evaluation of which the individual has learned by practice.

The inhibition of reflexes may, likewise, be produced by such stimuli that are applied from the outside. Such conditioned reflexes can be developed in the spastic for curative purposes. However, one must take especial precaution not to evoke an excitatory action of any newly added irritating agency. So, by applying a second and third stimulus, an interchangeability is possible and the visual

and auditory impression may be put to use. This is especially useful in spastics: the auditory and visual impression may be used to control reflex movements by inhibition and to develop timely and rhythmic movement as would ordinarily come about under the full control of the cortex of the brain. By the development of secondary conditioned reflexes new associations can be created which are of great help in the control of the spastic movements. In order that such reflexes be possible, however, the cortex is needed and no conditioned reflex potentialities remain after removal of the cortex; only the local reflexes remain but these cannot be used for developing new, conditional reflexes. If the trouble in the brain is circumscribed, if the destruction of the cortex is only partial, conditioned reflexes may be established; but it is much easier to produce an excitatory secondary reflex than one which has an inhibitory effect.

V. Practical Application

How can all this mass of evidence coming from the laboratory be put to practical use in physiotherapy?

A. So far as the fatigue is concerned, it means that the application of

1. Rest
2. Relaxation, and
3. Re-establishment of the normal blood

circulation of the muscle are the three principal therapeutic measures. The effect of fatigue upon the mechanical response may be shown by the behavior of a poliomyelitic muscle which had been subjected to stretching.

The threshold of fatigue of the paretic muscle is extremely low and efforts which otherwise appear entirely insignificant may lead to very considerable degrees of fatigue and exhaustion.

The excess of tone during the earlier stages of fatigue and the subsequent development of clonic tremors are further phenomena which are significant in the application of physiotherapeutic measures. A healthy muscle is characterized by a marked degree of recuperability. In certain muscular affections, such as progressive muscular dystrophy, fatigue occurs very readily, but recovery also takes place promptly. In other conditions, particularly in peripheral and poliomyelitic paralysis, in which the threshold of fatigue is very low,

recuperation, on the other hand, is extremely slow.

B. In the spastic conditions it is well before deciding on physiotherapeutic measures to have at least an approximate conception of the seat of the principal pathological changes. Cerebellar changes are characterized by tremor and ataxias, sometimes by catalepsy, adiadochokinesis, that is inability to perform rapid alternating movements. Many movements of great toxic complexity, for instance, the progression, can be carried out co-ordinately in the absence of the Rolandic cortex, whereas, on the other hand, lesions of the cerebellum greatly disturb these motions. But even in the absence of the cerebellum there is no difficulty in achieving the upright position as the reflex tonus is not involved; but delicately adjusted movements are impossible. These types of spastic are characterized by the suddenness in which movement starts and then continues beyond the allotted time. They cannot stop themselves. For this reason also, the maintenance of the upright position appears difficult. These are particularly the cases which are in need of additional visual and auditory stimuli to prepare new paths by which the cerebellar insufficiencies can be compensated.

From newer investigations we also learn that a differentiation can be made between disturbances of the cortex and the lower centers, particularly the corpus striatum. Destruction of the outer portion that is the *nucleus lentiformis* and *putamen* produce a spastic irritability in form of a hyperkinesis, athetotic or choreatic uncontrolled movements. Whereas, if the inner or lower center, the *globus pallidus*, is likely involved, there is more the attitude of an akinesis, a weakness and slowness of uncontrolled motion. In general, the farther the destruction reaches below the cortex the more difficult it will be to provide for adequate substitution by furnishing new paths of inhibition.

C. Static and Dynamic Muscle Training.

There is a distinction between the training of the musculature in isometric and isotonic contraction. In the former, the muscle is not allowed to shorten but during the contraction the tension constantly increases; whereas in isotonic contraction the muscle shortens and performs actual mechanical work under more or less constant tension. In isometric contrac-

tion all chemical energy is converted into heat and no visual work occurs; on the other hand, in isotonic contraction, mechanical work is accomplished, but because of several factors, such as incomplete shortening, premature relaxation, and internal friction, the work accomplished is incomplete; it only amounts to one-third of the theoretical maximum work.

D. Exercise Technic.

1. Free and Restrained Exercises.

These facts shed some light on the practice of resistant dynamic exercises which are of such paramount importance in mechanical re-education of muscles. So far as exercises, carried out under restraint, are concerned, we must remember that an optimum length of the muscle exists, and that the greater the initial distension or stretching, the greater, in general, is the isometric tension developed. This, however, is only true to a certain point. When the resistance increases beyond this, then further distension of the muscle tends to decrease the energy of contraction. This is important in passive exercises. The method of passive stretching of a shortened muscle by plaster cast or braces, if carried out beyond a certain point of resistance, impairs the efficiency of the muscle. In contraction, either free or against resistance, efficiency increases the more prolonged or the slower the contraction, but, in general, we find that the maximum efficiency of contraction is obtained when the latter lasts about $1\frac{1}{2}$ seconds. In contraction slower than this, the efficiency falls slowly. The natural efficiency of the muscle has been found to be about 26 per cent.

If we apply the isotonic contraction, that is, that in which the muscle is allowed to shorten, the efficiency of the muscle is greater because in this type of contraction the muscle draws upon sources of energy not utilizable in resisted contraction. For the choice of position in which to start exercises, it is well to know that the maximum of contractile power is reached when the muscle has a length of 1.4 to 1.5 times its natural length. This is usually the case in the extreme joint position; for instance, in the extreme extension of the elbow, the biceps assumes this length in comparison to its relaxed natural length.

2. For the avoidance of fatigue during exercise the following experimental facts are of importance:

Earlier signs of fatigue are revealed by changes in the action current curves, leading to the picture of clonic contraction. The low threshold of fatigue is to be considered in planning and administering exercises. That recovery from fatigue is slow in paretic muscles has been mentioned. It must be complete before exercises are taken up again. It seems that in muscles fatigued entirely from local biochemical changes, recovery is speedier than in neuromuscular fatigue, especially if the circulation is otherwise intact.

3. In the treatment of spastic conditions the principal aim is the establishment of conditioned reflexes. They are best procured by auditory or visual stimuli. Such "control" reflexes can be utilized very largely in the development of coordinate and rhythmic play of the musculature, for the static functions as well as for the more complex movements of the upper extremity.

4. We can, finally, check up on the effect of muscle training by recording the increasing efficiency of the locomotor act. In pathological locomotion, casual observation gives only very inaccurate ideas of efficiency. More exact information of the expenditure of the motion can be obtained by measuring first the metabolic changes, especially the excess oxygen intake, and then by comparing it with the output of actual mechanical work. In this way we arrive at an efficiency index of the locomotor act. For instance, in cases of congenital dislocation of the hip, we found the expenditure, or cost, to be several times that of the normal gait, and the "efficiency" correspondingly less. So, we can measure the effect of muscle educational treatment, alone, or combined with operative methods. Another, more simple method of measuring the value of muscle training in terms of efficiency is to correlate standard motions to the speed in which they are carried out, assuming that the actual metabolic cost increases with the slowness of motion. We have made use of this plan, particularly in muscle education of the upper extremity, both in spastic and in paralytic cases. The increase in speed denotes gain in accuracy and precision of motion.

Discussion

Dr. James W. Martin (Omaha, Neb.): To add anything to this masterful elucidation of the principles of muscle action given by Dr. Steindler this morning is certainly beyond my power. I think this is a paper that must be read and studied very carefully before we will get a true appreciation of the work that it represents.

The stimulating thing to me as a young man is that a man who is as busy as Dr. Steindler in the practice of orthopedic surgery is willing to give the effort and time to theoretical investigations. It is this sort of work that carries on the torch that Duchenne first held up, Sherrington after him, Bevier, Lombard, and other physiologists who have helped to show us the normal physiology of muscle and help us to cope with the pathological states.

I think if we consider the paper fully we will find many applications to practice that Dr. Steindler has not taken time to point out. One very salient point I think is his insistence that the blood supply to muscles must be undisturbed if we are to obtain the maximum function from the muscles. It has many implications in the treatment of fractures, for example, by braces and splints.

The importance of our recognizing fatigue he has stressed, and I think of that in connection with the exercises that we give in the simple case of weak feet with deformity where we wish to strengthen the posterior tibial and anterior tibial muscles. We can probably do a tremendous amount of harm by prescribing exercises that are carried out too vigorously or too long at a sitting.

We might go on at great length and point out other, what we might call, practical applications of these physiological aspects, and yet, as I stated in the beginning, I feel we can add nothing to Dr. Steindler's paper.

I wish to express again my appreciation of the opportunity to hear such a paper.

Dr. Arthur Steindler (Iowa City, Ia.) closing discussion: I have nothing to add to what Dr. Martin has said, except to offer an apology for bringing up a physiological subject when everybody knows I am supposed to be an orthopedist. But my reason for presenting this subject is that I cannot see any progress in orthopedic surgery without physiology.

Indeed, I am firmly convinced that everything which is interpreted as real progress in the domain of medicine must include a study of its physiologic background. Everything that means real progress must include physiology. That is the reason I think we ought to be interested in physiology of locomotion. It is very difficult to work your way through, but is the only way, I think, to progress.



TREATMENT OF SCIATICA BY PHYSICAL MEASURES *

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Sciatica has been considered as a disease entity for so long that few have thought to look further into the condition. Most physicians have accepted the prevailing ideas regarding its cause and treatment without question. As Riley⁽¹⁾ states, "Generations of medical students have been taught that any patient who comes into a clinic or office stating that he has a pain in the buttock which radiates into the dorsal aspect of the thigh and downward into the leg has sciatica." Such patients are then told that they have a neuritis of the sciatic nerve and are started off on a course of treatment that generally does not prevent the patient from getting well in spite of the doctor's stumbling efforts. None of the procedures recommended in neurological books can be called specific. They are practically all symptomatic treatments for neuritis. The general term "neuritis" has become so established in the minds of the laity and the profession, that both are now satisfied with the designation which has come to cover a number of pains not of real neuritic origin.

Neurologists were wont to believe that absence of the Achilles reflex was absolutely necessary for the diagnosis of sciatica, and a good many of them still consider the condition a disease of the nerve and recommend what they may think are specific treatments to act upon the nerve itself. Counter-irritation along the course of the nerve by cupping or actual cautery still is used. Some men who wish to be new-fashioned and possess a mercury arc lamp, sunburn the skin off a patient's leg with the lamp, giving some slight relief by the sunburn through counter-irritation set up, as by cupping and cautery. Many neurologists believe it is necessary to administer alcoholic injections to inhibit the nerve from all function and it is surprising to find in the literature that some of the older workers in Europe even recommend surgical scraping of the nerve. It is a matter of record that even amputation of the limb has been advocated. The literature from European spas contains much about

the specificity of certain muds used to treat patients with sciatica and in fact, there are many fantastic ideas, all of which are intended to act specifically upon the nerve but really get their beneficial effects just through warming of the limb.

Before taking up the most frequent conditions causing pain down the sciatic nerve, it is worth while mentioning some of the conditions that possibly give pain which, being discovered on thorough examination and specifically treated, will aid in relieving the patient. The most common cause, as will be gone into later, is the effect of muscle spasm pressing upon the sciatic nerve. Probably eighty per cent of so-called sciatica can be attributed to this condition. However, it is important to keep in mind that more serious conditions can cause secondary muscle spasm or can themselves, by increasing intrapelvic pressure, cause the symptoms of a neuralgia of the sciatic nerve. The most frequent of these extraordinary causes is probably arthritis of either the sacroiliac joint or the lower lumbar spine. This causes muscular spasm in the adjacent region, which, as will be explained, by pressure causes sciatic neuralgia. Intrapelvic conditions, such as retroversion, fibroids, adnexal induration and congested prostates, also can be the etiological factor and when they are specifically treated, as can be done so efficiently with physical therapy, the pain is frequently relieved. It also should be remembered that it is possible to find a bursitis underneath the gluteal muscles, which has been known to cause stubborn, typical pains radiating down the leg.

The staff at the Neurological Institute in New York has studied with interest conditions that have been called neuritis without sufficient pathological evidence. Tilney, with Casamajor and Riley, have done considerable clinical and laboratory research, and Wilder Penfield, now of McGill University, who was formerly at the Presbyterian Hospital, has been very emphatic because of his laboratory findings, in his conclusions that ordinary sciatica is not a pathological condition of the

* Read before the Tenth Annual Meeting of the American Congress of Physical Therapy, Omaha, Nebraska, October 8, 1931.

sciatic nerve. Incidentally, his researches also have led to the conclusion that brachial neuritis, so-called, can be classified in the same manner. Older workers in electrotherapy who were keen enough to make worth-while observations, have noted that the best place to administer physical therapy in cases of sciatica is in the region of the sciatic notch. Their experience, as has been the writer's, has been corroborated by the more recent results of research, all of which have shown that the neuralgic pain radiating down the sciatic nerve is due primarily to a myositis. Of course, with conditions as mentioned above, the myositis is secondary to something else, but it can be held directly responsible for spasm of the pyriformis and gluteus maximus muscles causing pressure on the sciatic nerve as it comes through the sciatic notch. This pressure is not equal on all fibers of the nerve; consequently those fibers which are irritated by pressure convey to the brain sensations of pain in the areas of the leg from which it is usual for them to convey such sensations. It is well known that after amputation of the foot, a patient complains of sensations in the amputated foot. These sensations are due to similar pressure on nerve fibers by contractures in the stump which convey to the individual sensations of pain in the non-existing foot.

In Riley's⁽¹⁾ paper, referred to above, similar observations are recorded. He states: "On examination, certain simple physical symptoms can be detected. In the first place, no evidence of involvement of the central or peripheral nervous systems can be elicited. Definite, localized, more or less acute tenderness to direct or deep palpation over the muscle mass itself is always present, and in favorable instances it is possible to find areas of apparent infiltration in the muscle tissue which may be so numerous as to give the impression of rubbing the thumb over a corrugated washing board."

As in all cases of myositis of any long standing, although the general cause is trauma or irritation, if the condition does not respond quickly to treatment, it is necessary to search for a focal infection. Very frequently cases will respond almost completely and then will remain stubbornly chronic. These cases acting in this way are object lessons that their continuance is due to a focal infection. Of course, myositis that accompanies a chronic arthritis also will continue to recur as long

as the irritation from the arthritis is important.

An interesting observation made in the histories of a large number of cases is that frequently before the pain attacks the sciatic nerve the patients have had a transitory or prolonged attack of what they call lumbago. They will say that the pain was diffuse across the back, then centered in one hip or buttock and then has radiated down the back of the thigh. This should attract attention of more clinicians to the peculiar part that the muscles play in the picture. If one looks through the literature, especially in the field of physical therapy, many references will be found to the necessity of applying negative galvanism for stimulating the nerve, or positive galvanism for the sedative effect along the course of the nerve. Some men even recommend diathermy from the hip to the foot to warm up the entire nerve. Understanding the true cause of sciatic neuralgia, it is easy to see that this diffuse treatment supposedly directed to the entire distal portion of the nerve is wasting both the patient's and the doctor's time.

In the clinics in New York where over 600 cases have been treated under the writer's personal supervision, it is the routine procedure to forget entirely that the nerve is in the picture and devote exclusive attention to the treatment of the myositis in the region of the sciatic notch. Even in cases where the condition has been of such long standing that the trophic disturbances are evidenced by atrophy of the muscles, the same procedure is carried out. These long standing cases are treated with diathermy through the pelvis in the above mentioned region, while the acute cases are started with radiant light. After a real hyperemia has been acquired, static electricity is applied in the form of the wave current followed by sparks. In the initial acute stages the static effluvium is administered because of its less drastic action. Before any case is finished it always is treated with static wave and sparks.

Recently in discussing this condition with the doctor in charge of the Electrotherapy Department in St. Thomas' Hospital in London, the question was brought up by him as to whether or not the condition was a real neuritis when it has existed long enough to induce muscular atrophy. This is a debatable point that can be discussed either way. According to what Penfield has said there is no

microscopical evidence of a pathological condition, but when atrophy has occurred the pressure must have been of such long standing as to cause some serious interference of the certain fibers in the sciatic nerve that have to do with the nourishment of the limb. As no one has described the micro-pathology accompanying such a condition, it seems safe to assume now that the condition is not a serious affection of the nerve, because under proper treatment the muscles easily can be caused to regain their natural size and there is no permanent injury evidenced when the patient is well.

Inasmuch as clinical experience for the past five years, particularly watched because of the attention drawn to the situation by Professor Penfield, has produced such consistently gratifying results, it is felt that this understanding of sciatica should be brought to your attention. Extremely stubborn cases of many months' standing have responded to the treatment outlined, and acute cases are easily relieved in remarkably few treatments. Static electricity is the current that produces the quickest results through its decongesting effect, as well as its ability to stimulate muscle contraction. Somewhat similar effects can be achieved by the use of the sinusoidal current and for those who have not a static machine available, this current is recommended. Do not waste time galvanizing or diathermizing the sciatic nerve in the belief that the condition is a true neuritis. Such a condition is extremely rare. It is very probable that there is no specific effect of the diathermy current on the nerve itself when passed along the length of the leg because there are tissues of much less resistance through which the current can go. It is only a general heating effect of the member that gives any relief. In a true neuritis of the nerve, such as is caused by lead or alcohol poisoning, it is, of course, necessary to use the galvanic current. These cases do not have the typical symptomatology of ordinary sciatica and, as a true neuritis, should be so treated.

Observations of Casamajor,⁽²⁾ Professor of Neurology in Columbia and one of the Directors of the Neurological Institute, will support the contentions raised above. In a personal communication he states:

"You have asked me to write you of my ideas of the thing that is called 'sciatica.' At the present time the term is used to describe a pain in

the leg and thigh. Originally it described a pain in the hip (See New Oxford Dictionary). 'Sciaticus' was the hip and the feminine form 'sciatica' was a pain in the hip. Why pain has to be feminine is not for a bachelor to say.

"As used today 'sciatica' is a pain in the lower extremity. The condition has nothing to do with the sciatic nerve and never did. The sciatic nerve is not involved and the pain is not in the distribution of the great sciatic nerve. There have been some post-mortem studies of sciatic nerves from cases of 'sciatica' and no changes were ever seen. The one case of interstitial neuritis of the sciatic which I have sectioned was from a patient who never had sciatica.

"The most constant finding in these cases, in my experience, is a mass of extremely tender muscle fibers in that part of the gluteus maximus that runs from the trochanter directly cephalad to the pelvic hip. This occurs in nearly 100 per cent of the cases usually called sciatica. I consider this to be due to a muscle inflammation — a localized gluteal myositis. The best results are obtained by treating these muscle fibers. Methods giving deep heat seem to give better results than massage.

"I do not know why myositis in this region should give pain down the leg any more than I know why myositis in the infraspinatus should give pain in the forearm (usually called brachial neuritis). I only know that they do. Nor do I know why the ankle jerk is absent in gluteal myositis with leg pains. It frequently remains absent for a long time after the pain is gone.

"I do not know whether the gluteal myositis is a primary thing or not. One frequently sees it in spinal cases — such as osteo-arthritis. Many people have a tender spot in the muscles where I have described this one and have not 'sciatica.' However, extreme tenderness and a lump as of indurated muscle is seen only in patients with 'sciatica.' Some years ago Wilder Penfield took out some of this painful muscle from a case of 'sciatica' and told me he found round cell infiltration. I don't think he ever published it."

It is therefore particularly recommended, inasmuch as physical therapy is of such great assistance when used as referred to above, that it is applied correctly to the pathology presented, keeping in mind that a neuralgia is far more common than a neuritis of the sciatic nerve.

Conclusions

1. In the light of recent studies, sciatica is not a disease in itself but rather a complex symptom due to localized muscular involvement, which produces by virtue of exudates and muscle spasms, pressure, and hence pain, referred to the sciatic nerve.

2. No specific form of therapy has as yet been discovered.

3. Medicinals and local injections have a limited value.
4. Counter-irritants in the form of cupping, actual cautery and local ultraviolet offer only temporary relief.
5. Heat in any form is a measure of partial value unless followed by static effluvium, wave or spark.
6. The proper modulation of all physical agents, intelligently applied, has been the

means of reducing the pain and limited motion in the shortest period of time.

7. The present report is based on the observation of 600 cases treated chiefly by static electricity.

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THE ANTI-PHLOGISTIC ACTION OF INFRARED RAYS

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Perhaps the choice of the term, anti-phlogistic, as descriptive of the therapeutic action of infrared radiation is not entirely a fortunate one. It is not a word in common usage in medical parlance. In the minds of many, it is most likely to be associated with a certain proprietary preparation of medicated Kaolin giving off a strong aroma of wintergreen and other barber shop fragrance. Such widely accepted understanding of the word is not only a tribute to the astuteness of the manufacturers of this pharmaceutical in selecting such a distinctive name but it also serves to emphasize the character of the properties we wish to discuss in this paper.

Infrared radiation is more positive and dependable as an anti-phlogistic than topical applications and other counter-irritants because it introduces and adds heat under constantly controlled conditions while, on the other hand, the latter only serve to retain heat.

The relief of inflammation by measures applied directly to the parts involved includes a great variety of means by which the temperature of the inflamed parts can be raised. This is the object sought for whether hot compresses, moist dressings, dry packs, light rays, diathermy, poultices or other means are resorted to. This being the case, it would seem as if the controversy that every now and then occurs as to the relative merits of dry heat or moist heat is an absurd reflection on the comprehension of such antagonists of the

precise physical characteristics of the effects produced and the character of the physiological response. One would almost be lead to believe that there must be more than one kind of heat, and that the heat derived from one source might be a little different from that of another.

To properly appreciate the merits of infrared radiation in the treatment of a great variety of clinical conditions characterized by inflammation, it is necessary, first of all, to have a clear conception of just what occurs when we bring about an increase in temperature in a circumscribed part of the body. In stating the problem in this way, the question naturally arises as to whether all the effects induced by infrared radiation can be explained as the result of its thermal action. We mention this for more than academic reasons because we so often observe the tendency to attribute to these emanations from an infrared lamp some mysterious property that is not obtainable from other sources of heat. Why this fancy should continue to persist is a mystery in itself. I presume we may account for it in some degree by the love of mystery, a natural human weakness that from which the medical profession is not exempt.

If, however, we can agree that the effect of infrared radiation is a thermal one and, therefore, no different than the thermal effects produced by other means, we can lay down the same general principles regarding

the indications for its use as pertain to the use of heat derived from other sources. In doing so, we do not by any means minimize its importance as a therapeutic measure. The great value of heat as a remedy is often greatly under-estimated simply because it is so commonplace.

Heat is anti-spasmodic, analgesic, de-congestant, sedative; it increases phagocytosis, accelerates chemical activity, increases the oxygen exchange, and hastens the absorption of exudates and extravasations. These effects pertain to the body as a whole as much as to any discrete parts acted upon. An artificially induced hyper-pyrexia is of greater usefulness, however, in its local application than when it involves the entire body on account of the depressing action in the latter case if sustained over a long period or if it is frequently repeated.

It would seem rather paradoxical to speak of heat having a decongestive action when its most apparent action is to bring about a dilatation of the arterioles with a greater engorgement of blood in the tissues and visible reddening of the surface. This seeming contradiction, however, is only the result of a failure to distinguish between an active and passive congestion. The latter form is painful as observed in bruises, sprains, and infectious process'. The fact that relief from pain invariably follows the application of heat in these morbid conditions is evidence that the vascular reaction is altogether different. Along with the relief from pain, there is usually a noticeable subsidence in the swelling and infiltration of fluid in the tissues as additional indication of an alteration in the circulation.

This increased absorption of exudate with the application of heat is frequently misinterpreted and leads to an attitude of timidity in its use in acute infections because of the inference that the dilatation of the arterioles is likely to lead to metastasis of the invading organisms and a greater dissemination of the infection. All experience, however, has established the fact that this is one of the surest means of keeping the infection localized. It is well known that an infection extends more readily through the lymphatics than through the blood-stream, largely because the endothelial wall of the blood-vessels acts as a most resistant barrier to bacterial invasion. As a demonstration of such resistance we need only

recall the great vascularity of exuberant granulation tissue in an infected wound. One explanation of the effectiveness of heat in limiting the extension of infection may be found in the fact that, aside from the inhibiting action on the infection of the mobilizing of the cellular elements of the blood that results from arteriole dilatation, this same engorgement serves by pressure on the surrounding tissues to seal the lymphatics.

The understanding recognition of these principles is of great practical importance in the management of many clinical forms of infection. They operate in the same degree in a maxillary sinus infection, a tonsilitis, an otitis media, a pneumonia, an infected wound, an arthritis, and even a suppurative appendicitis.

The idea of including the latter as amenable to heat may appear as a rather startling and radical departure from orthodox procedure. To modify our position in this respect a little, we may add that we have reference only to its use following surgical drainage. I have not had the temerity personally to apply infrared radiation to acute appendicitis as a substitute for operative interference but a certain surgeon whose ability and judgment I have great confidence in, told me that he has aborted more than one case by this means. Theoretically and in consideration of results secured in analogous conditions, it might be possible to save a number of these vermiform appendages from the knife by this method if we could accumulate more experience with it in cases that refuse operation or in which operation may be contra-indicated. Post-operatively, however, it can be relied upon to greatly shorten the convalescence and to promote healthy granulation of the drainage wound to such a degree as to eliminate the fear of post-operative hernia. In some cases by combating shock and preventing the development of general peritonitis, it has repeatedly proven to be a life-saver.

It is not necessary in these cases where there may be considerable drainage to apply the radiation directly to the skin surface. A moist dressing kept hot by means of a lamp or electric pad will accomplish about the same result as direct irradiation. It is better to give a fairly intense radiation in interrupted periods of thirty to forty minutes on, and an hour and a half to two hours off than to

give a more moderate application continuously, as the more intense the radiation the deeper the penetration of the heat into the tissues. I have demonstrated to my own satisfaction under experimental conditions that increases in temperature of several degrees can be readily secured by conductive heat through the abdominal wall, and others have likewise established this fact so there need be no misgivings about the efficiency of this method. Fever and elevation of pulse rate can be counteracted by cold compresses to the head.

This same technic, thirty minutes on and two hours off, can be followed in the treatment of pneumonia. Such radiations are far more reliable than plasters or poultices, and the patient seems to derive a gratifying comfort from them. The psychic effect is entirely favorable and more agreeable than with diathermy where there is always an element of dread associated with an electrical apparatus. Some years ago, Lindsay reported twelve cases of pneumonia treated by infrared radiation at the Madison General Hospital, all of which ran a favorable course and the duration of fever was considerably shortened. A St. Louis doctor told me of six cases of broncho-pneumonia in children that he treated in the winter of 1925 with infrared with most gratifying results—the respiration being noticeably improved in depth and rate with the first application. My experience has been too limited to draw any conclusions as to how decisive a factor it is in the management of pneumonia, but these optimistic reports together with the satisfactory course shown by those cases I have used it in would seem to justify a more extended adoption of this method.

As a first aid treatment of infected wounds, there is no doubt that the routine use of infrared radiation would prevent suppuration in many cases that would otherwise not be amenable to disinfection. Even where suppuration is already present, it offers the most convenient and most positive means of limiting the extension of the infection. Fig. I shows a crushing injury of the index finger immediately after the loose fragments of bone

were removed and hot, wet dressings applied. This might readily have been judged a case for amputation. After the first dressing, the clot was expressed and only dry dressings were used, the treatment consisted of bathing the parts with 2 per cent di-chloramine and a twenty minute infrared radiation daily. It is important to keep such wounds warm at all times. I always instruct the patient to apply a hot water bottle when going to bed.

The wound healed rapidly and painlessly. Patient was discharged five weeks after the accident with no permanent disability and a mobile joint.

By applying the infrared rays early to boils and even carbuncles, the infection can frequently be destroyed and the tumefaction will disappear without incision. I have repeatedly aborted an acute tonsilitis by applying a twenty minute radiation to the angle of the jaw, first on one side and then the other. Four cases of Bell's palsy obtained a restoration of function in three to four weeks. In view of the excellent results that consistently follow their use in peripheral neuritis involving sensory nerves, there appears to be some justification for believing that the infrared treatment was a positive factor in the uniformly favorable course of these cases of facial paralysis.

Many other clinical conditions have been described in which the infrared rays were the *sine qua non* in the treatment but the above are sufficient to establish their effectiveness as an anti-phlogistic. In conclusion, it may be well to remind ourselves that the merit of any treatment measure is determined largely by the judgment and skill exercised in its use and that successful treatment usually involves a properly selected combination of remedies rather than an unreasoning dependence on a single, routine remedy.

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A CONSIDERATION OF SOME FORMS OF PHYSICAL THERAPY IN OTOLARYNGOLOGY *

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In the interest of his patient the progressive physician, be he in general practice or in a specialty, should add the various electrical modalities to his armamentarium, and should possess sufficient electrotherapeutic knowledge to apply them adequately for the relief of diseased conditions. Let me begin by considering the uses of high frequency electric heat, or what is now called diathermy, in the treatment of ear diseases. As in other specialties an accurate diagnosis is the first step that should be taken before instituting treatment.

For the purpose of our study we must divide deafness into five classes: First, hard of hearing caused by suppurative disease of the middle ear, mastoid or labyrinth, conditions which are not influenced favorably by the use of diathermy. Second, spongification of the bony capsule of the labyrinth — commonly called otosclerosis — which does not seem amenable to treatment by this or any form of therapy. Third, cases of nerve deafness due to derangement of the eighth nerve or one of its terminal branches. This condition is also not improved by diathermy. Fourth, inflammatory conditions of the middle ear following acute suppurative and non-suppurative inflammations. These cases respond well to diathermy. Fifth, those cases so common in aural practice, such as chronic low grade infections and inflammations of the middle ear (usually a progressive stage of pharyngeal and nasopharyngeal infection) which are also in quite a proportion of cases improved to a marked degree, or cured by this agent.

Electrodes are in many forms, some ingeniously made and applied. My preference is for small pencil-like electrodes wound with cotton — wet with normal saline — and introduced into the external auditory canal on each side. These electrodes should exactly point toward each other to get the proper effect. The parts traversed by the heat are the middle ear, the eustachian tubes, and the

nasopharynx — and to a limited degree the immediately surrounding structures. The current should be turned on gradually to tolerance, and continued from five to fifteen minutes according to the effect one wishes to produce. Careful measurements of hearing before and after use should be carried out. The heat should be modified to suit the patient's comfort regardless of the milliampere reading.

As a rule improvement in hearing should be noticed in from six to eight treatments, and then it is advisable to extend the periods, being guided by measurements of hearing acuity. When the limit of improvement has been reached the treatments should be continued once a week, once in two weeks or once a month as required.

There are many other indications for the use of diathermy, and we can consider it from both the medical and surgical aspects. For the relief of pain and congestion diathermy is useful in a selected number of cases, but when there is confined pus it is contraindicated.

In acute laryngitis small electrodes can be used, one each side of the larynx, over the thyroid cartilage for ten to fifteen minutes, using as much heat as can be comfortably tolerated, following this with the slow sinusoidal current for five minutes and the surging sinusoidal current for five minutes.

In acute non-suppurative otitis media electric heat can be applied by means of the pencil electrodes as above described.

Acute tonsillitis is favorably influenced by electrodes placed under the angle of the jaw on each side, and the heat turned on to tolerance.

Headache due to an obstructed nasofrontal canal, or to early frontal sinus congestion, can be relieved in some cases by the indirect method. This is applied through the operator's body. The patient is connected with one pole of the high frequency current by a divided cord, holding a terminal in each hand, and the

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operator is connected with the other pole by an electrode in the palm of the hand. The circuit is made by the operator pressing a finger against the inner angle of the orbit on the affected side. Contact as warm as can be borne comfortably is used for five to ten minutes. In cases where indirect diathermy is not successful in giving relief saturation in the high frequency chair is useful, the operator bringing out the spark with the finger tip against the skin at the inner angle of the orbit.

Pain over the antrum when there is no confined pus can be treated in the same way — by direct or indirect methods.

Surgical Diathermy

Electrocoagulation of the tonsils is one of the accomplishments of the present generation and in cases where clean dissection and snare, or operation by the LaForce method — either local or general anesthesia — seems contraindicated, then electrocoagulation fulfills a long felt want. The one stage method by this procedure as advocated by a few operators in this field seem to me undesirable, but the removal of a portion of the tonsil at each of several sittings is on the whole fairly satisfactory. The objection to this method, if the tonsils are of fair size, is that four, five or six treatments are needed usually to each tonsil. There is considerable pain following each treatment, and the treatments must usually be extended over six to eight weeks' time. The advantages are that the end results are good; the patient loses no time from his or her occupation; hemorrhage is rare, and the chances of complications are reduced to a minimum.

Fulguration is sometimes used as a supplementary operation to smooth over irregularities and obliterate pockets where food might lodge, decompose and furnish a focus of infection.

Until recently I have followed the generally accepted technic. That is, using a six by four pad against the back of the neck or upper spine for the indifferent electrode, and a straight or curved needle as condition demanded, attached to the other pole of the high frequency machine. I formerly tested the strength of the current on a piece of raw meat, but later found that I could gauge the strength of the current accurately by bringing

the two electrodes in contact, watching the spark and noting the sound. I found that when the spark was right in my machine about four hundred milliamperes would be required. The needle is now pushed into the tonsil and hold there until a gray ring is formed about the electrode. This takes from three to six seconds. Three rings are formed on one tonsil, and the opposite one is not treated until five days or a week later.

At the present time I am using the Doane⁽¹⁾ method, which confines the current to the tonsil areas. Doane has devised a set of electrodes for the indifferent pole, one of which is selected as best adapted to fit the structure about the tonsil area. Although my experience by this technic is limited, I am inclined to think that it is the better one, and that the claims of Dr. Doane, viz: less current required, area of coagulation more exactly controlled, pain and reaction lessened; less danger of oedema and after hemorrhage, and injury to the pillars, are justified.

Hurd⁽²⁾ has shown that electrocoagulation as a means of destroying infected lymph follicles in the nasopharynx, or obliterating tubal adhesions, is practicable.

Beck⁽³⁾ has used successfully electrocoagulation in the reduction of hypertrophied inferior bodies in fifty or more cases. His technic is to introduce a long needle active electrode its whole length into the turbinate body, keeping it close to the periosteum, then turning on the current slowly and withdrawing the needle. Healing and reduction take place in from two to four weeks. I have used this procedure in a few instances, and also in the destruction of nasal adhesions with good results.

New⁽⁴⁾ advocates electrocoagulation in the removal of benign growths in the nose and throat, and destruction of synechia and malignant tumors.

Combination Treatment

In the treatment of deafness the effects of diathermy treatments can be increased by the use of varied forms of vibration. The surging sinusoidal current gives electrical massage, and is of value. From three to five minutes duration should be sufficient, and a weak current should be used at first, and gradually increased to comfortable tolerance. Flickers in the eyes sometimes give the first

intimation of too strong a current. This treatment in my practice generally follows the diathermy application. I have found air vibration through the eustachian tube by means of the otoconcussor devised by Dr. Philip Rice to be helpful in many cases of deafness of the middle ear of the catarrhal type in elderly people, and the auditor is of value in these cases.

In the treatment of chronic suppurative otitis media I have had considerable success with ionization. Here the galvanic current is used from a machine so constructed that the current can be quickly and exactly regulated. It is indicated in the treatment of any form of infection in accessible parts of the body, and ions of soluble medical substances can be carried into the tissues. Some of these can be introduced by use of the positive pole, and some by the negative. For instance, the positive charge will introduce zinc salts; copper, mercury, and silver. The negative, chlorine, iodine, salicylate, and all acids. The strength of the solution should be from one to two per cent. Treatments of from five to ten minutes with a weak current — two mils. — are better than those of short duration with a strong current.

Zinc sulphate, one or two per cent is my choice in the treatment of suppurative otitis media. The external auditory canal is filled with the solution — the patient lying on the opposite side from the ear under treatment — a specially guarded electrode introduced into the canal (using the positive pole for the zinc solution), the indifferent electrode attached to the patient's wrist, and the current turned on very slowly. If the patient becomes dizzy the current should be slowly decreased, and used only at such strength as tolerance will allow — about two mils. is the usual dose.

It is important that the ear canal be thoroughly cleansed by peroxide, suction, and swabs before introducing the electrodes.

Treatments should be repeated every three or four days, and if there is no improvement after the fourth treatment further medication is in my experience useless.

The treatment of long suppurating antra can often be carried out to advantage by following a similar technic, a nasoantral resection having been previously performed, and a permanent opening established. I have had no experience in treating other infected sinuses by this method.

Phototherapy

I have found that the ultraviolet light is useful in a limited number of cases of hyperesthetic rhinitis — both chronic and periodic — and have used the Curay light and small applicators for this purpose, allowing the patient to introduce the applicator into the nose as far as possible without causing pain. Five minutes for each side is the average time required. In cases of acute rhinitis it is also useful.

Conclusions

Almost every pathological condition in the upper air tract, apart from malignancy, and where there is confined pus, can be improved by heat, and electrical and mechanical massage. These improve the circulation, help the elimination of waste material, and stimulate the tissues to renewed activity. The tonic effect of the ultraviolet light, autocondensation, and proper exercise, are measures which should not be overlooked in the patient undergoing treatment for local affections.

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THE TREATMENT OF DEAFNESS BY THE ZUND-BURGUET ELECTRO-PHONOIDE METHOD: SUMMARY OF FORTY CONSECUTIVE CASES *

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Set out in tabular form below is a rough summary of results obtained in the treatment by means of the Zünd-Burguet method of forty patients suffering from deafness. These patients were the first who underwent this treatment at my hands.

As I believe that I was the first aurist in Australia to make use of the method in the treatment of deafness (being closely followed by Dr. Blashki, of Sydney), I feel it my duty to publish my experiences.

The method had previously interested me for some years, and during the early part of 1926 I visited Paris especially in order to obtain first hand information of Zünd-Burguet's apparatus and his method of treatment. Zünd-Burguet is a scientific man, but not a practical otologist. In fact, he is not medically trained, and I soon discovered that he was not even competent to sort out the varieties of deafness. At the same time, in spite of these adverse factors, I was sufficiently impressed by what the patients seen by me (all of whom, by the way, happened to be women) said concerning the results of the treatment, that I invested in one of his machines, for I considered that even if it were possible to obtain one-tenth of the good results that Zünd-Burguet claimed for his method, it would be worth a patient's while to undergo the course of treatment. I started off enthusiastically, but after carefully observing the forty consecutive patients detailed here, the results obtained satisfied me that the method was far from scientific as regards the treatment of deafness and noises in the head, and the benefits derived were very few and slight. In deaf people, as has been remarked before, we have not only the deafness and noises in the head to contend with, but also that "fullness in the head" which is a frequent symptom. In re-

gard to this last factor, most of my female patients suffering in this way were satisfied that they were improved by the treatment, but not so the male. Noises, in only a few cases, were lessened to a degree which made the treatment worth while.

Of the 40 patients detailed, 26 were females and 14 males. It is interesting to note that only three of the 14 males improved in hearing and this improvement was only of a very transient and questionable nature. This brings out a characteristic which is frequently observed in deaf females, that is, they are very easily "buoyed up" by almost any form of treatment and give responses to tests which must be carefully scrutinized; otherwise the practitioner may be misled into believing that they hear better than they do. Males are very much less liable to this fault. Amongst the females in the series the best result obtained was in Case 9, a doctor's wife. She was definitely improved, but retrogressed in a short period after each course (three in all). Subsequently she improved greatly after Wood's intratympanic iodine treatment, but subsequently relapsed, only to improve with further treatment. Patient 11 was a highly-strung music teacher. She is convinced that the treatment cleared her head of fullness and noises. Patient 13 is worth mentioning as one of a class of people who become obsessed with treatment and its imagined beneficial effects. I still had difficulty after completing several courses in making her understand what was said by using a "loud voice." No improvement was apparent to tests and she still complained that "her noises were sending her mad."

I feel that the public should not be buoyed up with hopes regarding the results to be expected from this form of treatment. Very early in my experience I realized this and made it a practice to inform my patients definitely before beginning treatment

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SUMMARY OF RESULTS OF ZUND-BURGUET'S ELECTRO-PHONOID TREATMENT OF DEAFNESS.

Number.	Sex.	Age.	Deafness.	Noises.	Fulness.	Result.
1	F.	64		Continual.	+	Discontinued after five <i>séances</i> . "Noises made worse."
2	F.	35	Air conductive, right nerve.	Right +		Slight improvement in hearing. (?) Due to previous other forms of treatment.
3	F.	29	Air conductive, paracusis.	Perpetual six months.	four + years.	Clinically there is no improvement in hearing.
4	F.	63	Air conductive.	+		No difference after forty-three <i>séances</i> .
5	F.	62	Air conductive, slight nerve.	Nil now.		No difference.
6	F.	24	Air conductive, paracusis.	+		No improvement.
7	F.	44	Air conductive.	+		No improvement.
8	F.	21	Air conductive, paracusis.	+	+	Unsatisfactory type, gave up treatment.
9	F.	24	Air conductive.	+	+	Improved in every respect, but retrogressed; had three courses in all.
10	F.	36	Air conductive, slight nerve, paracusis.			After eighty <i>séances</i> no improvement at all.
11 ¹	F.	28		+	+	She states there is a very great improvement.
12	F.	58	Air conductive, slight nerve.			After 101 <i>séances</i> she states she is better in health and her hearing has improved considerably. Clinically there is no improvement.
13 ²	F.	60	Air conductive.	++		Patient stated in two weeks she could hear better. "Heard alarm clock ticking and also wristlet watch."
14	F.	65	Air conductive, nerve.			Sometimes thinks she is better.
15	F.	30		+		Disappeared after three <i>séances</i> .
16	F.	36	Air conductive, paracusis.	+		During treatment patient was very pleased and said she was improved in hearing and that noises were less. Later reported previous condition returned, but it was no more than before treatment.
17	F.	58	Air conductive, slight nerve.	+		No difference.
18	F.	33	Air conductive, slight nerve.	++		Thinks she can hear better, but tests reveal no improvement.
19	F.	44	Air conductive.	+	+	No difference.
20	F.	48	Air conductive, nerve, and paracusis.	+		No difference after forty-five <i>séances</i> ; left off treatment.
21	F.	27	Air conductive, paracusis.	+	+	Improved for a short time and then returned to previous condition.
22	F.	28	Early air conductive.	+		Four separate short courses. Had to stop each on account of noises which were made worse by treatment.
23	F.	59	Advanced air conductive.	+		No improvement hearing or relief from noises. Better in general health and sleeps better.
24 ³	F.	64	Advanced conductive and slight nerve.	++		After first course, said she heard better; after second course, no improvement.
25	F.	40	Conductive +	+		After forty-two <i>séances</i> , hearing better. Tests revealed no change. Later she said she was no better than before treatment.
26	F.	72	Nerve ++	+		Says "hearing improved wonderfully," and her friends say she hears better. No difference in tests.
27	M.	35	Air conductive.	+	+	No improvement.
28	M.	7	Deaf mute.			No improvement.
29	M.	59	Very advanced nerve.			No improvement to tests, but says he can hear the trams better.
30	M.	27	Air conductive, paracusis.	++	+	He says he improved temporarily, but previous condition returned.
31	M.	14	Air conductive, paracusis.			No improvement.
32	M.	11	Partial deaf mute.			No difference in hearing.
33	M.	9	Air conductive.			No improvement.
34	M.	16	Advanced air conductive, early nerve, paracusis.			"No better in hearing, but better in health."
35	M.	35	Advanced air conductive.	+	+	No improvement.
36	M.	35	Air conductive, slight nerve.	+		"No improvement in hearing, but noises have gone."
37	M.	95	Air conductive, paracusis.	++		Slight improvement in hearing and relief from noises while under treatment. Return to former state.
38	M.	47	Nerve.	+	+	No improvement.
39	M.	38	Air conductive.	+	+	No improvement.
40	M.	16	Air conductive.	+	+	No improvement.

¹ This patient was a music teacher whose ears were very sensitive.
² This patient haunted my surgery and demanded continual treatment—although I and my attendants could appreciate no improvement in hearing. Eventually she was convinced that she was making no headway.

that the benefits derived would at most be but small. As in all other instances of certain lines of treatment, we have our enthusiasts among the practitioners and among the patients, and in a few instances patients have worried me to continue the treatment, in spite of my being convinced that it was not doing them any good.

I have tried this method on four deaf mutes and can affirm that no improvement whatsoever resulted. When one considers that to carry out Zünd-Burguet's directions in their entirety entails the application of his vibration instrument (which, by the way, is an ingenious electrical one) to the mastoid region, the back of the neck, down the spine and even to the abdomen, and that Zünd-Burguet insists upon the supplying of this molecular vibrator as part of his outfit, one realizes that there is a certain amount of quackery about the method. The treatment entails anything up to 80 *séances*, each lasting eight minutes, and it is obvious that these take up a lot of the specialist's time. I have relegated this treatment, which I seldom use now, to my nurse, who has learned to do it as efficiently as myself, and only a very nominal fee is charged. That a practitioner should charge, as is done by certain specialists in England and elsewhere, full fees for this form of treatment is, I think, not justified by the results obtained.

In conclusion, I consider that the summary of my first forty cases has emphasized

that at most but little good results from this form of treatment. I have been persuaded to record my experiences in order to support this conclusion, and also to warn the general practitioner and through him the public, that the claims of Zünd-Burguet and his followers should be received with caution. I think that the method belongs even to a lower class than the treatment of deafness by galvanism, pneumatic massage, ultraviolet rays and that popular form of treatment, it seems for all ailments, diathermy. In the treatment of deafness we can generally help our patients, sometimes to a surprising degree, by undertaking treatment along the various accepted avenues, namely, by directly improving the patency and condition of the Eustachian tubes and middle ears; by rectifying nasal and naso-pharyngeal conditions, which indirectly improve the aforementioned structures; by making injections into the middle ear itself through the drum, after the method of Wood; by Vodak's (of Prague) treatment by sodium arsenate given internally; by the internal administration of small amounts of iodine over long periods; by the judicious use of extracts of the endocrine glands, which probably act directly on the acoustic nerve, *et cetera*.

If we conscientiously treat our deaf patients in a thorough manner, I feel that we would be much more satisfied with our results than by resorting as a routine to a questionable form of treatment such as the Zünd-Burguet electro-phonoid method.



Charles Francis Stokes

(1863-1931)

Rear Admiral Charles Francis Stokes, sixty-eight, U. S. N., retired, died in the New York Naval Hospital in Brooklyn on Thursday, October 29. He had been surgeon general of the Navy from 1910 to 1914. He was buried at Arlington, Washington, D. C., with full naval honors.

Admiral Stokes was a veteran of the Spanish-American War; he also saw service in the Boxer rebellion in China and in the Philippine insurrection. A pioneer in abdominal surgery, he devised the first aid dressing which was used in the World War by the Army and Navy. He also devised the Stokes splint stretcher.

Dr. Stokes was a native of New York and attended Adelphi Academy and the Polytechnic Institute in Brooklyn and the College of Physicians and Surgeons in Columbia University, from which he was graduated in 1884. He became an ambulance surgeon at Chambers Street Hospital the year before his graduation and in 1884 was appointed house surgeon of Bellevue Hospital.

He entered the Navy as assistant surgeon in 1889 and was made surgeon May 31, 1900. During the Spanish-American War he was operating surgeon aboard the ambulance ship *Solace* and became executive surgeon of the Naval Hospital in 1899. From 1903 to 1906 he was President Roosevelt's surgeon.

Dr. Stokes commanded the United States Naval Hospital at San Juan, Porto Rico, from 1906 to 1908 and was recalled by the Navy Department to command the United States hospital ship for service with the Atlantic Fleet during the world cruise of 1908.

He was the first medical officer to command a hospital ship and he succeeded Dr. Presley M. Rixley as surgeon general in 1910.

In 1915 he was appointed by Mayor Mitchel director of the New York City Retreat for Drug Addicts and Inebriates at Warwick, in Orange County.

From 1919 to 1928 he was engaged in private practice in New York. He wrote a number of monographs on military and general surgery. He was an enthusiastic disciple of Physical Therapy and contributed unstinting support to its development in the way of some significant studies on the problem of deafness. The world of Physical Therapy deeply regrets the untimely death of this gentleman and scholar. The members of the American Congress of Physical Therapy take this occasion to offer deep condolence to his beloved wife and children.

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EDITORIALS

"COLD-QUARTZ"

Mercury vapor lamps in glass, invented by Arons in 1896 and first manufactured by Peter Cooper Hewitt in 1902, are well known and require little comment. Essentially, these lamps comprise a mercury arc in vacuum and represent the prototype from which there later evolved the mercury vapor arc in quartz. Kromayer, Nagelschmidt, Henri, von Recklinghausen, Nogier and Courmont contributed mainly to the development of the quartz lamp, which development was rather well advanced by 1905.

In its present commercial form, the mercury vapor lamp, until recently, involved extremely high temperatures in the generation of ultraviolet light. This is true also in the case of the so-called water-cooled lamps. Air-cooled lamps are those that are not cooled at all; water-cooled lamps are those in which the intense heat generated in the tube is absorbed by circulating water more or less efficiently disposed around the quartz tube.

Early users of these lamps attempted to dis-

tinguish between the effects procured with one or the other forms of apparatus. It was claimed by some that the air-cooled lamp was useful mainly as a general tonic and for the stimulation of systemic effects; and on the other hand, the water-cooled lamp was particularly indicated where the therapeutic results sought depended largely upon the securing of pronounced bactericidal effects. Differences in the spectral distribution issuing from each type of lamp were claimed, and these in a large measure existed. Thus, since much of the infra-red (heat) is absorbed by the circulating water which surrounds the tube in the water-cooled lamp, it follows that the energy which issues is poor in heating effect and proportionately richer in ultraviolet and visible light component than is the case with the air-cooled or really un-cooled lamp. Others have sought to show that even the quality of the ultraviolet spectrum is unlike in the case of the two lamps, the water-cooled type favoring greater intensity in the region $\lambda 253.6 \mu\mu$. Finally, practical advocates classed the water-cooled lamp as an instru-

ment for "orificial" treatment and recommended its use in sinuses, wounds, discharging ears, throat afflictions, and wherever focalized light appeared required.

That the air-cooled or so-called systemic lamps developed into highly useful and unrivaled therapeutic commodities need hardly be mentioned. The entire renaissance of the study of rachitis culminating with the startling discovery of the synthesis of vitamin-like substance as the result of ultraviolet (and other) irradiation is an everlasting monument not alone to the realm of biophysics, but in particular to the realm of physical therapy. It cannot be too emphatically stressed, also, that every user of ultraviolet energy, whatever else is his assumed designation, such as pediatrician, surgeon, or the like, is a successful physical therapist at least during the period that he employs the energy for the prevention or the cure of rachitis.

The water-cooled lamp has not fared as well. There are ample reasons why this should be so. The most conspicuous reason, it would seem, is its relative inefficiency (as compared with an air-cooled lamp). To project the ultraviolet energy upon any given locus by means of the water-cooled lamp required generally the use of applicators, quartz rods and lenses, whose claims to efficiency have been perhaps somewhat exaggerated. Not only have the "miracles of the conduction of light and ultraviolet through quartz" been most inadvisedly heralded as being nothing short of revolutionary in the realm of science, and this conduction is certainly not any more astounding than the usual conduction of ordinary light through usual glass rods, but the very manner of attaching the applicators to the lamp made for a most wasteful and insufficient supply of radiation. Excepting in rather few and uncommon occasions, the usual use of a water-cooled lamp is little short of useless. There are numerous other drawbacks, to be sure, but the relative inadequacy of the instruments as supplied is still the outstanding indictment.

By a form of logical reasoning which is as admirable as it is simple, it has occurred to the creative mind of the mechanic to overcome the shortcomings of what should be a very needful physical therapeutic equipment, —something that does what the water-cooled lamp should do. Everyone knows that the

closer the source of light is approached, the greater is the intensity. But to approach too closely to the source of ultraviolet furnished by the mercury arc in quartz develops the difficulty that the heat encountered is excessive and passes beyond the unbearable point to become even destructive. But the problem would be solved if it were possible to furnish light without, or with only a minimum of heat; and just that has been accomplished in what is now available as "cold-quartz."

Of course, "cold-quartz" means nothing only insofar as it implies ultraviolet light from a source contained in quartz and practically devoid of heat. This is simply accomplished by passing a high frequency discharge through mercury vapor contained in quartz. It is the principle used so ubiquitously in the cold light display signs where Neon, Argon, Mercury Vapor and other gases are excited to their severally brilliant illumination.

This "cold-quartz" principle is sound. There has resulted already some worthwhile observations in connection with its use, as exemplified by Hibben's report, published elsewhere in this issue. First, as far as can be learned now, the cold-quartz type of lamp yields a far greater ultraviolet output for energy input than any other type of lamp yet known. It is an approaching counterpart to the cold light of the efficient fire-fly. Next, its spectrum emphasizes certain ultraviolet components and reveals wavelengths of this energy which are occluded or absent in the other forms of lamps. Also, it solves the problem of how to carry ultraviolet, and practically ultraviolet alone, to the deeper recesses in a convenient and effective form, for the very quartz applicators have literally been hollowed out and have been transformed into miniature but relatively intense ultraviolet generators. These miniature generators may be introduced without discomfort due to heat, since it is cold "light" that they furnish, and with much therapeutic value because the distance that separated the tissue to receive treatment from the actual source of light has been reduced merely to the thickness of the wall of the applicator-generator.

Cold-quartz equipment is furnished, like "hot" quartz equipment, in forms intended for general bodily irradiation and localized treatment. Naturally, some of the effects of the general or systemic form of apparatus will be

similar to those obtained from the air-cooled lamp; but certain differences will also become apparent. An outstanding difference is the promptness with which the cold-quartz produces erythema. Another difference, due no doubt to the greater proportion of short ultraviolet wavelengths in cold-quartz, is the more prompt and the more effective bactericidal action, observed particularly in the treatment of such infections as acne and the like.

The final evaluation of cold-quartz as a worthwhile therapeutic device is contingent entirely upon two factors, first, a thoroughly proper and complete research into the biophysical characteristics of the energy supplied by this form of equipment; second, diligent and adequately controlled clinical research.

Some biophysical research is already on way, and its results will be eagerly sought by many. Pioneer workers in the use of radiation for the synthesis of vitamins are experimenting and comparing the value of cold-quartz with other forms of lamps for the production of vitamin D in *in vitro* and *in vivo*. The University of Illinois workers who are investigating the effects of ultraviolet rays on sundry alkaloid and other drugs have included cold-quartz equipment in their experiments. Large industrial laboratories are experimenting with this comparatively new form of light. All the results of these activities will be attentively studied. From these studies, what place cold quartz is to fill in physical therapy, if any, will eventually appear.

To be sure, physical therapists need to be informed concerning the nature and the scope of usefulness of any newly introduced development. Manufacturers cannot expect a practising physician to accept a new apparatus and to have them experiment with it on the clients of a private practice without rather full knowledge of the applications and limitations of an energy. Nor can physicians expect a manufacturer to invade the practice of medicine in order to obtain the required information. However, the burden of proof is on the manufacturer, and to him belongs the duty of collecting such authoritative information in respect to his product as will encourage proper clinical experimentation on the part of willing physicians. This has not always been the case with other physical therapy equipment introduced in the past. But the time has come when conscientious physical ther-

apists will avoid the lure of unproved and highly fanciful speculation in regard to the "merits" of a measure, *new or old*, in favor of a truthful statement of fact, however, insignificant the fact may appear, evaluated by proper methods.

Cold-quartz bids fair to physical therapeutic recognition. It has a place, perhaps, just as air-cooled and water-cooled ultraviolet have theirs. If it differs from either, the differences must be revealed. If its effects are more or less marked than the older forms of ultraviolet use, these must be indicated. Until these facts are verified, all interested observers will do well to adopt a tolerant attitude. The problem is how to solve the adage,

Be not the first to cast the old aside,
nor yet the last by whom the new is tried.

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ADVANCES IN ELECTROSURGERY

The keen interest now manifested in electrosurgery is the result of more than a decade of pioneering in this field. Reluctant at first to adopt it in his practice, the surgeon has gradually fallen in line, until, at present, he staunchly advocates the method for the management of malignant growths and for numerous other indications. It is indeed noteworthy that in a review of the recent literature several important contributions are to be found on the subject. It is especially noteworthy since many of these contributions have been made by leaders in the surgical specialty.

At a conference on electrosurgery, before the Clinical Congress of the American College of Surgeons, Philadelphia, October 13-17, 1930, several important presentations were placed on record. Nadeau, discussing his practical experiences in electrosurgery, stated: "In our clinic at the Augustana Hospital, we have used since 1926, electrosurgical units based on radio frequency. The method was first used in treating cancer of the breast and has since been utilized either exclusively or

as an adjunct, for the following purposes: (1) to remove malignant disease surgically, (2) to produce coagulation, (3) to treat infections, (4) to reduce hemorrhage from cut surfaces, and (5) to sterilize cut surfaces."

"It is in the surgical removal of malignant disease that this method has its greatest advantage. In removal of epitheliomata of the face or elsewhere, of warts and moles, and in carcinoma about the face, jaws, and lips the searing of cut surfaces with the electric current probably has prevented many recurrences which would have followed the use of the scalpel." Nadeau summarizes his paper by the following: "The electrosurgical unit in its present state of development is a distinct advance in modern surgical technique. It is a new method, the details of which must be thoroughly familiar, not only to the surgeon, but to the entire staff of assistants and nurses.

Lilienthal also has been impressed with the use of the electrosurgical unit and believes that the outstanding features of electrosurgery are the saving of time, the greater assurance of asepsis, and the reduction of what may be called the massage effect, so dangerous in operating through infected or neoplastic structures.

Practically every specialty has benefitted by the progress which has been made. While the general surgeon greatly appreciates the added facility which has been placed in his hands, the urologist, the gynecologist and the otolaryngologist have lost no time in carrying on experimentation in their respective fields.

In urology, electrocoagulation for tumors of the bladder is now recognized as a procedure which by far surpasses the classical excision. It is generally conceded that no tumor, whether benign or malignant, should be removed by the scalpel. The pioneer efforts of those urologists who attempted to establish a scientific basis for the destruction of bladder

cancers by diathermy have been rewarded by this rather uniform opinion.

The gynecologist, too, has had unusually favorable experiences with electrosurgery. One need only refer to recent articles dealing with conization and other procedures to pass judgment on the interest which is now manifested in the newer science. The electro-surgical treatment of cervicitis and of cervical and uterine new growths is regarded as an improved method of managing these conditions. The old fashioned cautery has been superseded simply because it is an agent inferior to surgical diathermy.

In otolaryngology, electrocoagulation has found a wide field of usefulness. Malignant growths of the head and neck, either accessible or rendered so by exposure, are attacked more successfully than by the older surgical methods. That electrosurgery is now being experimented with for indications other than malignant is but a natural development.

The surgeon who has become somewhat enthused with electrosurgical procedures after mastering them to the best of our present knowledge has turned his attention to the development of apparatus, electrodes and technic. This is significant because it at once places a stamp of approval on the method but suggests the need of further development. Improvement is destined to result further in other directions. Surgeons have entered the field for purposes of experimentation and are devoting time and money in intensive research.

The early pioneers are gratified. They have earned a much deserved victory. While another decade will doubtless see revolutionary advances in electrosurgical apparatus and technic, the basic method is here to stay, at least until such time that investigators will demonstrate a superior therapy.

Warburg Awarded 1931 Nobel Prize in Medicine

Dr. Otto H. Warburg, German scientist and cancer specialist, was awarded the 1931 Nobel prize in medicine for his studies of the respiratory organs. The Swedish Academy of Medicine, which makes the award, announced he would receive his prize from King

Gustav, Dec. 10.

Dr. Warburg was awarded the Sofie A. Nordhoffjung prize for cancer research in 1926.

Last year's Nobel prize in medicine was awarded to Dr. Karl Landsteiner, American, who is associated with the Rockefeller Institute in New York.

QUERIES AND CLINICAL NOTES

Q. Is medical diathermy of value in the treatment of chronic tonsillitis?

A. Two methods have been suggested. One is the application of an active electrode externally on the neck of the affected side and the indifferent electrode on the opposite side. Treatment is given for twenty minutes daily until the tonsils assume normal size and appearance. The other method has been termed by its author, electrosterilization of the tonsils. Cahall (*Texas State J. of M.*, Jan., 1928), first described the technic, which although practical, has not been generally adopted. The author gives the technic as follows:

"No anesthetic is necessary unless the patient is extremely nervous and gags from the mere presence of a foreign body in the mouth or throat. The unipolar or Oudin current is used. This is a current of high voltage and relatively low amperage; it is connected to a tonsillar electrode which is pressed against the surface of the tonsil being treated and the current, which has previously been tuned down to a comfortable degree of tolerance, turned on with a foot switch and held until the patient complains of the degree of heat. The electrode is removed and the patient is allowed a moment or two of rest, when it is again applied to the same tonsil, and this procedure is repeated from 8 to 10 times; the other tonsil is treated in like manner. Care must be taken that the current is not too strong, that a wooden or glass tongue depressor is employed, and that firm contact with the tonsil is obtained.

"It is not the intention in this procedure to fulgurate or sear the tonsil, but to establish within the tonsillar structure as high a degree of internal heat as the patient will tolerate. Thus all micro-organisms that may be present are killed. The tonsil is sterilized, fibrosis is eliminated, swelling and inflammation subside and the patient experiences a grateful improvement in the feeling of the throat following the first treatment. It requires from 12 to 15 treatments to effect a

cure. The treatments may be given daily or even twice a day. Not only is there no edema produced but there is an actual shrinkage of the tonsil; at the conclusion of the treatment these organs are reduced to normal size. Uniformly favorable results have been obtained. The only instances of apparent failure were because of non-cooperation on the part of the patient."

Q. Is zinc ionization useful in ethmoiditis?

A. This method has been repeatedly discussed in the literature, but a recent article by McCoy (*Laryngoscope*, September, 1930), describes the technic. McCoy found that by using a solution of zinc sulphate at the positive pole and ordinary saline at the negative pole zinc ions were driven into the exudate and into the membranes of the cavity. After the nose is clean, it is anesthetized with a 4 per cent cocaine solution for five minutes. Then the cavity is filled with a 2 per cent zinc sulphate solution applied on cotton. A zinc electrode is attached to the positive pole of a galvanic battery and placed in contact with the fluid. The patient holds the negative pole in his hand. The author cites one case of antrum infection which persisted after three nasal operations. Six milliamperes of current of ten minutes duration was employed for three treatments at four day intervals. In this manner the antrum condition was cured. He cites another case of chronic ethmoid and sphenoid inflammation and another frontal sinus infection which were cured by zinc ionization. A slightly different technic is suggested by McCurdy (*Rhode Island M. J.*, October, 1931).

Q. Has infrared radiation any influence on gonorrhreal ophthalmia?

A. There is no reference to the use of infrared in this condition, but Armstrong (*Physical Therapeutics*, April, 1928) has employed radiant light. He states: "Applying radiant energy, there is created a hyperemia

which opens the channels of drainage, relieves the stasis, and brings in all of nature's own antibactericidal resources to overwhelm the already weakened germs. There is also an antiseptic effect directly from its heating action upon bacteria, which cannot thrive within certain temperature limits."

According to the author radiant heat-light is of great help in gonorrhreal ophthalmia. There is reason to believe that infrared may be much more efficacious in this ocular disease.

Q. Has the altitude of the sun any relation to its antirachitic effect?

According to Tisdall and Brown, (*J. A. M. A.*, **92**:860, March 16, 1929), a marked increase occurs in the antirachitic effect of sunshine when the sun reaches an altitude of 35 degrees or more. A study of the geographic distribution of rickets shows that it is uncommon or exists chiefly in a mild form in those places where the minimum seasonal altitude of the sun is not below 35 degrees. Conversely, severe rickets is chiefly encountered in those cities where the altitude of the sun is below 35 degrees for some months of the year. The period of the year during which rickets will probably develop can be calculated for any city of the world. The duration of this period may be altered, however, by the prevention of exposure of patients to highly effective sunshine on account of inclement spring weather or other factors.

Q. What physical methods are employed in the treatment of trigeminal neuralgia?

A. Schurig (*Therapie der Gegenwart*, Heft 2, Jg. **70**:94, Feb. 1929) reports 41 cases of trigeminal neuralgia which were

treated by physical methods. Only five did not improve. The treatment is commenced with the high frequency current which is well tolerated after four or five applications. The current should be applied in so feeble a dose as to be hardly felt. If favorable progress is not made within a few treatments the galvanic current is resorted to and minimum dosage is given, such as one m. a. for from 15 to 20 or 30 minutes. If the results are still unsatisfactory, the author resorts to diathermy. In most cases the pain is removed after five to ten sittings. The author postulates that all trigeminal neuralgias be first submitted to an intensive electric treatment. Only in case of failure should injection or surgical treatment be instituted.

Q. What are the effects of radium and x-ray upon the fetus in utero?

A. Toombs (*Am. J. Obst. & Gyn.*, **17**:517, April 1929) states that diagnostic exposure is not harmful unless resorted to too frequently. Therapeutic exposure causes abortion in the early months and various deformities of eyes, brain and cord during the later months. The severity of dosage and the period of fetal development determine the particular reaction of the individual fetus tissues, the younger the embryo the greater the injury.

Malignancy superimposed upon pregnancy demands measures sufficient to destroy cancer, the life of the fetus being disregarded.

In obscure cases, pregnancy and fibroids coexisting, and in elderly women, the probability of pregnancy should always be kept in mind in order to avoid subjecting the supposedly absent fetus to immediate death or something worse.



CURRENT NEWS AND SCIENCE

New Officers—1931—American Congress of Physical Therapy

President, F. H. Ewerhardt, M.D., St. Louis; President-Elect, Gustav Kolischer, M.D., Chicago; First Vice President, Albert F. Tyler, M.D., Omaha; Second Vice President, Luther A. Tarbell, M.D., New Haven; Third Vice President, J. Severy Hibben, M.D., Pasadena; Fourth Vice President, N. H. Polmer, M.D., New Orleans; Secretary, Frederick B. Balmer, M.D., Chicago; Treasurer, John Stanley Coulter, M.D., Chicago.

More effective treatment of cancer and other diseases will probably follow the hoped-for adoption of an international unit of measurement for radium and roentgen ray by the International Congress on Radiology which met in Paris July 26 to 31. Standardization of such a unit of measurement was one of the principal problems to come before the meeting. At present it is not always possible to give exactly the dosage of roentgen rays or radium prescribed by European physicians for a given condition. This has hampered research and also medical practice somewhat. If an international unit is adopted, a physician in one country can give a treatment with the exact amount of roentgen rays prescribed by a physician in another country just as he now can give exactly the same dose of castor oil or quinine which can be measured by already standardized international units.

Dr. Lauriston Taylor, Washington, D. C., physicist of the department of roentgen ray measurements of the United States Bureau of Standards, attended the congress with his "portable roentgen ray yardstick." This instrument provides a standard unit for accurately comparing the intensity of roentgen rays from different roentgen ray tubes. Dr. Taylor's standard of measurement had already been adopted by the United States and was to be considered by the congress.

Dr. Edwin C. Ernst, St. Louis, who represents the Radiological Society of North America, and Dr. Taylor were the United

States members of the committee which was to consider this matter of standardization. The conclusion of this committee was almost certain to be adopted by the congress.

Other delegates from the United States to the congress were: Dr. Albert Soiland, Los Angeles, representing the American Medical Association; Dr. Benjamin Orndoff, Chicago, representing the American College of Radiology; Dr. George Grier, Pittsburgh, representing the American Radium Society; Dr. N. E. Titus, New York, representing the American Congress of Physical Therapy, and Dr. George E. Pfahler, Philadelphia, representing the American Roentgen Ray Society. Alternates were Dr. Sherwood Moore, St. Louis; Dr. William E. Chamberlain, Philadelphia; Dr. A. U. DesJardins, Rochester, Minnesota, and Dr. Thomas A. Groover, Washington, D. C.

Mme. Marie Curie, co-discoverer of radium, was honorary president of the congress and was presented with the gold medal of the American College of Radiology.

Edwin N. Kime, M.D., of Indianapolis, has been made a member of the medical advisory committee of the Washington National Research Foundation, which is carrying on a series of scientific experiments.

A new stethoscope instrument for examining the lungs by listening to the breathing, works by electricity and produces a chart showing the condition of the lungs graphically.

The word magnet comes from the fact that the best specimens of lodestone are obtained from Magnesia, a city in Asia Minor.

X-Rays Find New Beauties for Students of Flowers

Searching the secrets of a flower's heart acquires new esthetic significance at least, and may become of importance in plant physiology and anatomy, too, through an x-ray technique developed by Mrs. Hazel Engelbrecht, of Des Moines. It is not the first time that

x-rays have been used on flowers; but Mrs. Engelbrecht has brought to bear a rare combination of most sensitive control of her unusual medium and an appreciation of pictorial composition that makes the result, though novel, art in its truest sense. — *Science News Letter*, October 10, 1931.

Rejuvenation of Glass Accomplished by Heat

Rejuvenation of tired glass has been accomplished in experiments by A. Q. Tool and R. Stair of the U. S. Bureau of Standards.

Special glass used to pass ultraviolet light and permit the sun to give its full share of health rays to man, may get tired and refuse, as ordinary glass does, to let the health rays through. But the experimenters found that by heating this glass at about 500 degrees Centigrade for a few hours, it may be brought back to ultraviolet transparency.

Chemical changes involving oxidation of the iron content of the glass are usually held responsible for its gradually becoming opaque to ultraviolet light. Mr. Tool and Mr. Stair considered the phenomenon called "thermoluminescence." It seemed as though the glass absorbed light when in use, becoming discolored and tired. Then during the heat treatment it gave off its pent-up light in a glow which lasted until its discoloration had disappeared and it was ready to serve again.

The temperature treatment if too low will not completely restore tired glass to its former transparency to the ultraviolet light, the experimenters explained. — *Science News Letter*, October 10, 1931.

Ultraviolet Light and High Frequency Current Harden Steel

Hardening the small metal parts of typewriters, sewing machines, and the like may be speeded up by the use of high-frequency radio currents, ultraviolet light, and the electric spark, according to a report presented by John J. Egan, research metallurgist of Long Island City, N. Y., before the American Society for Steel Treating, in Boston.

The steel is given this desired "case hardening" by nitriding, Mr. Egan explained. This previously has been a slow process, involving the heating of the steel while it is placed in a nitrogen atmosphere. After many hours of heating in contact with the nitrogen gas, it

is cooled and its surface or "case" has become hardened.

But by subjecting the metal to ultraviolet light or to electrostatic fields caused by the electric spark or high-frequency radio currents, nitriding is speeded up and hard satisfactory cases are made in a short time, he reported. While Mr. Egan does not believe these methods to be commercially applicable at the present time, he thinks that further experimentation should make them so.

Alloys of precious metals should prove useful in other fields than dentistry, the society was told by Prof. R. C. Brumfield, of Cooper Union, New York City.

Gold, silver, platinum, palladium, and other rare elements, when alloyed with the baser metals, have service qualities that can be known only by actual experimentation, according to Prof. Brumfield. It is estimated that eight million combinations are possible, each with its unique characteristics. Only a few of them have ever been developed, and these have been used in dentistry. The resistance of these alloys to discoloration and their possibilities for heat treatment recommend their use elsewhere, Prof. Brumfield said. The ultimate strength of some of these metals is as much as 90 tons per square inch. The strength of steel ranges from 50 to 100 tons per square inch. — *Science News Letter*, September 26, 1931.

Diathermy in Tuberculosis of the Skin

M. Bordier (*Bruxelles-Medical*, December, 1930) reviews the various forms of cutaneous tuberculosis; namely, tuberculous lupus, verrucous tuberculosis, tuberculous ulceration and lupus erythematous. He believes that of all the forms of treating tuberculosis of the skin, that offered by diathermy is the best. By this method is obtained immediate hemostasis, sterilization and coagulation of the lesions, deep action on the underlying tissues, and general improvement in the condition. — *Urol and Cut. Rev.*, (July) 1931.

Metal, Though Good Conductor Now Insulates Against Heat

Metal, ordinarily thought of as a high conductor, is being used to stop heat. This new type of insulation, using aluminum foil as a basis, has been demonstrated as superior to the old methods and finds a wide application.

So Max Breitung says in a report to the American Society of Refrigerating Engineers.

For insulation purposes, sheets of aluminum as little as .0003 of an inch thick are crumpled irregularly and assembled in layers. The limited area of contact allows a very small transfer of heat, and the foil has the advantage of not storing the heat as well as of being light and untarnished by air.

Following research both in German and American laboratories, aluminum foil is being employed in the household, in fish and meat industries, on railroad lines, and as an insulant for both brine and steam pipes on German cruisers. One of the French Merchant Marine vessels now under construction has been fitted with four tons of these sheets.

—*Science News Letter*, September 26, 1931.

Predicts Atom's Secrets Solved

Dr. Arthur H. Compton, noted physicist of the University of Chicago and Nobel prize winner, stated at the close of the international physicists' congress at Rome that a new era in physical discoveries was at hand. The era will come, he said, as a result of the great amount of new and significant information developed during these meetings.

"During the last thirty years," he said, "the structure of the atom has been intensively studied and within the last few years we solved practically everything but the structure of the atom's innermost nucleus. We do not know yet whether when the structure of this nucleus is finally known it will make available to mankind the tremendous energy hidden within it.

"The principal information developed at this congress has come from studies of radioactivity, cosmic rays, and optical spectra. The most striking discovery in the field of radioactivity was that of Prof. Bothe, the German, who explained how he was able to produce artificial gamma rays for the first time. M. Gamow of Leningrad presented a remarkable theory describing what makes an atom of radium disintegrate.

"In their attempts to find a solution of the structure of the nucleus of the atom, members of the congress were led to doubt the independent existence of electrons. But perhaps the most startling suggestion was that of Rohr of Copenhagen who proposed that the principle of conservation of energy, which has been the bedrock of science for a century,

would probably need to be scrapped before a solution could be found."

Einstein Shows Relationship of Gravitation and Electricity Through Fifth Dimension

Announcement of existence of a fifth dimension that is at least sufficiently real to be used in mathematics is made by Prof. Albert Einstein.

The name and nature of the new dimension he does not explain, the announcement being a preliminary report, issued through the Josiah Macy Jr. foundation of New York, which has financed some of Einstein's recent work.

This fifth dimension is employed in a new set of mathematics to demonstrate the existence of a relation between gravitation and electricity.

Two years ago Einstein announced to the scientific world a series of super-geometrical equations which showed there is a connection between these two universal forces of creation.

But those Einstein equations failed to work "rigorously," that is, they did not fully stand the test of accuracy, and about a year ago he reported that he had been able to revise these equations so that they worked better. Both these sets of mathematics used parallel lines, which in a strange and unexpected fashion did not always remain parallel.

In adopting the fifth dimension mathematics Einstein is turning his back on both the former equations as explanations of gravitational-electrical kinship. In doing this he follows exact scientific practice.

Einstein is following the trail of an explanation of the mysterious link suspected to exist between gravitation and electricity. He says that his earlier conceptions of the parallelism as the explanation now appears to have been in the "wrong direction."

Contra-indications to Radiotherapy in Hypertrophy of the Prostate

When a hypertrophy of the prostate is accompanied by an infection, radiotherapy is dangerous in the opinion of Guilbert as reported in *Le Siecle Medical*, June 11, 1931.

A sufficient dose of x-rays may be expected to aggravate the symptoms of infection. Furthermore the use of the x-ray is not rational in advanced cases of prostatic hypertrophy accompanied by infection. The x-ray

cannot be expected to do any good except in the early stages of the disease.—*Uro. & Cut. Rev.*, (Aug.) 1931.

Radium Rays Three Times More Effective Than X-Rays

Though radium rays and x-rays cause reddening of the skin to nearly the same extent, the radium is about three times more effective in producing certain other biological effects.

This is the conclusion announced to the Optical Society of America by Dr. G. Failla and P. S. Henshaw of the New York Memorial Hospital.

The work has required the development of an apparatus which would measure equivalent, comparable doses of the two radiations. It was found that 500 roentgen units of radium gamma rays produced the same reddening of the patient's skin as 600 roentgens of filtered x-rays.

Other experiments were made on wheat seedlings. In both cases the effect of the radiation is shown as a stunting of the shoots and roots. Three times as much x-radiation was required in this case to produce equal effects. Hence it may be desirable to use higher voltages with x-rays for medical purposes.

Dr. Failla emphasized the fact that the suitability of a certain type of rays for a given tumor must always be taken into account.—*Science News Letter*, March 7, 1931.

Sky's Blue Believed Caused By Electron Streams From Sun

Electrons streaming from the sun may be the cause of our familiar but mysterious blue sky, Dr. Willi M. Cohn of the University of Berlin has concluded as the result of his experiments in which a blue light very similar to that from the sky was produced in the laboratory. Dr. Cohn is doing high temperature research at the A. D. Little laboratories.

Dr. Cohn experimented in Berlin with cathode rays in a high vacuum, formed in a tube similar to the x-ray tube. He allowed the stream of electrons, which is the cathode ray, to meet larger electrically charged particles of matter, known as ions, which are formed either from a piece of radioactive metal, such as thorium, or from a gas. The blue light appeared where the electrons and the ions came together.

This blue light can be broken up by prisms to form a spectrum or "rainbow" of continuous color, just as is found in sunlight. The blue light from the clear sky also shows a continuous spectrum, although gases, such as the air this light passes through, have quite different spectra, which show only thin colored lines. Dr. Cohn points out that at the upper layers of our atmosphere electrons continually arriving from the sun and ions of the gases which form our air meet in the intense vacuum of space. Since under such conditions in his laboratory the blue light which is so like the light from the blue sky is formed, he believes that the blue of the heavens may, at least partially, have the same cause as that of the laboratory.

Since the time of Newton scientists have speculated on why the sky is blue. The most successful explanation heretofore has been that of Sir John Tyndall and Lord Rayleigh which considers it due to sunlight broken up in a particular way by spherical particles in the atmosphere. Dr. Cohn states that his theory does not conflict so far as direct sunlight is concerned. He points out that the Tyndall-Rayleigh theory would expect the light from the sky to be polarized so that all its waves would vibrate in a particular way. The light produced by Dr. Cohn in the laboratory is not polarized, and daylight is only partly polarized, partly not.—(*Science News Letters*, August 29, 1931.)

X-Ray Tube of More Than Million Volts Installed

Not satisfied with two 600,000-volt x-ray tubes, California Institute of Technology physicians have installed a giant 1,200,000 x-ray tube in the new Kellogg radiation laboratory.

Under the direction of Dr. C. C. Lauritsen, nationally known x-ray expert, the tube was assembled. It occupies the center of a specially designed room. The tube is exactly 30 feet high.—(*Science News Letter*, August 29, 1931.)

Sunlight on Logs Cooks Beetles to Death

Direct rays of the sun are being utilized by forest service entomologists in exterminating destructive beetles which in recent years have killed millions of board feet of timber near Diamond Lake, just north of Crater Lake National Park. The treatment is applied by

felling beetled-infected trees and exposing the trunks to the sun in forest clearings.—*Science News Letter*, July 18, 1931.

Rival Theories of the Universe

From a letter in *Nature*, it is evident that the discussion of cosmic rays has entered upon a new phase. Dr. Hess, of the Institute of Experimental Physics, Graz, writes to suggest evidence that part of the cosmic radiation is due to the sun. If this should prove to be correct, says *Nature*, and the sun "and so presumably all stars to be regarded as sources of the rays, it will become desirable to reconsider critically the alternative view that they arise in interstellar space." This is the opinion of Dr. R. A. Millikan, who in his presidential address to the American Association for the Advancement of Science, last week, once more threw down the gage to those men of science who hold that the universe is passing away.

There are, indeed, two schools of thought. A week ago Sir James Jeans outlined the view which is held by the majority of British physicists, that the universe is slowly disappearing "like a tale that is told." Dr. Millikan and his co-workers maintain that this is merely part of the story: the universe is continually being rebuilt from the very foundations.

The experimental evidence for this point of view is extremely interesting. About three years ago Millikan and some of his associates published an account of their work upon cosmic rays. They had found that rays of great penetrating power were entering the earth's atmosphere from interstellar space. Such rays were sufficiently penetrative to affect instruments sunk in fifty feet of water. They had, that is to say, a power capable of penetrating six feet of lead. Further experiments were undertaken with instruments of greater sensitivity, and these were affected at a depth of 200 feet of water.

It was inevitable that such a phenomenon should give rise to much speculation, and this was further stimulated by the observation that the rays did not form a continuous band of radiation, but were distributed in three or four bundles of wave-lengths. Now it is one of the discoveries we owe to Einstein that there is a definite relation between the wave-length and the energy change that produces it.

Given the wave-length of a ray, the magnitude of the energy change can be calculated.

It was inevitable that this calculation should be made, and the results proved striking. The wave-lengths were seen to be such as would occur if helium, oxygen, and nitrogen, silicon and magnesium, and iron were being created out of the hydrogen atom. They seemed to bear witness to a process of re-creation beyond the solar system of half-a-dozen elements, while the second law of thermo-dynamics appears to indicate that the universe is running down.

Dr. Millikan's argument can be carried a step further. These elements, whose birth-pangs appeared to be disturbing his instruments, are not a mere random selection. They are unquestionably elements most widely distributed in the earth and even in the sun and stars. It is inevitable that the inference should be drawn that the material universe as we know it is being rebuilt. The universe is disintegrating, it may be; but it is being re-established from its fundamental units.

It is an interesting theory. It cannot be lightly brushed aside. Dr. Millikan is a Nobel Prizeman. He has conducted research which is everywhere recognized. But the position he takes upon this question is diametrically opposed to that of the most eminent British physicists. In his address to the American Association for the Advance of Science he summed up the situation in this way: The second law of thermo-dynamics may hold good for the solar system. But in interstellar space a reverse process is taking place. It will be instructive to see how this clash of opinion resolves itself.—(*Observer*.) *The Brit. Jour. Rad.*, August, 1931.

Single Oxygen Atom Turns Rose Geraniums Salmon

That some geranium flowers are rose pink and others salmon color is merely a matter of a slight change in a chemical formula. The chemical substances which cause these colors are nearly but not quite identical, it has been shown by R. Scott Moncrieff at the Sir William Dunn School of Biochemistry of Cambridge University.

Mr. Moncrieff has shown that the difference between the molecules causing the color in these two flowers is due to a single atom of oxygen. In a formula containing 22 carbons, 30 hydrogens and 13 oxygens the ad-

dition of one oxygen atom brings about the change in hue.

The two pigments also occur in certain varieties of dahlias and the purple aster.—*Science News Letter*, July 18, 1931.

The American College of Physicians Will Meet In San Francisco, 1932

The American College of Physicians will hold its Sixteenth Annual Clinical Session at San Francisco with headquarters at the Palace Hotel, April 4-8, 1932. Following the Clinical Session, a large percentage of the attendants will proceed to Los Angeles where a program principally of entertainment will be furnished April 9, 10 and 11.

Announcement of the dates is made particularly with a view not only of appraising physicians generally of the meeting, but also to prevent conflicting dates with other societies that are now arranging their 1932 meetings.

Dr. S. Marx White, of Minneapolis, is President of the American College of Physicians, and will arrange the Program of General Sessions. Dr. William J. Kerr, Professor of Medicine at the University of California Medical School, San Francisco, is General Chairman of local arrangements, and will be in charge of the Program of Clinics. Dr. Francis M. Pottenger, of Monrovia, is President-Elect of the College, and will be in charge of the arrangements at Los Angeles. Mr. E. R. Loveland, Executive Secretary, 133-135 S. 36th Street, Philadelphia, Pa., is in charge of general and business arrangements, and may be addressed concerning any feature of the forthcoming Session.

Invisible Alpha Particle Path Bent by Great Magnet

Alpha particles are the hearts of helium atoms. They are so small that nobody has ever seen them.

Yet, in spite of their diminutive size, M. Rosenbloom, of the Faculty of Sciences of the University of Paris, has found it necessary to use an electromagnet built of coils of wire a yard in diameter and operated by a small power plant to make them change the direction in which they are traveling.

With this apparatus for bending the paths of the swift alpha particles, the French scientist has found that the particles from some radioactive atoms like radium consist of dis-

tinct groups of equal speeds, the speeds of the groups, however, being different. This gives a means of finding out the structure of the intensely small core of the atom, which is the present goal of atomic physical research.

The most typical mode of disintegration of radium and other radioactive bodies is by the expulsion of alpha particles with great velocity and energy. These are helium atom cores. It has long been known that from a given element the helium particles appear to be expelled with the same characteristic speed. This indicates that the alpha particle occupies a certain definite energy level in the atom which is defined by so-called quantum conditions.

In the radioactive thorium-C atom, which has now been found to consist of a number of distinct groups each characterized by a certain speed, Lord Rutherford has pointed out, these groups disclose the existence of several energy levels within the nucleus.

Ordinary electromagnets are not able to cause sufficient deflection but with the assistance of the magnet Prof. Aime A. Cotton, at the Sorbonne, can bend the alpha particles round in a semi-circle and separate them out.—*Science News Letter*, July 18, 1931.

Beam of Light Carries Voice in New Phone

Transmission of the human voice by means of a beam of light has been accomplished here with simple apparatus.

The outfit used was developed by Dr. Gustaf W. Hammar, head of the physics department of the University of Idaho, and Lawrence W. Foskett, graduate student.

Dr. Hammar believes that the experiment opens up a new field of communication, especially in the signal corps and forest service.

A photo-electric bell such as used in sound motion picture projection machines is the basis of the "lightphone."

For their light source they used an ordinary manometric flame fed by acetylene gas. Before the gas reaches the flame it passes a diaphragm built into the base of the burner.

Talking into the diaphragm through a length of hose vibrates the gas, causing vibrations in the flame.

The light, directed by a reflector into a narrow beam, is picked up by the photo-electric cell, the vibrations amplified by a simple two-stage amplifier and made audible through tele-

phone receivers. Current was supplied by a 90-volt "B" battery.

Its portability and simplicity, the ease with which it is directed to any particular point and the secrecy which it provides are pointed out.

Dr. Hammar studied several years under Dr. Robert A. Millikan at the California Institute of Technology.

Sir Oliver Lodge Feels Reassured

Hove, Sussex, England, Oct. 14.—Sir Oliver Lodge, speaking tonight before the Chichester diocesan council, took sharp issue with the scientists who believe the universe is running down. Nobody knows, he said. In the end the process may be reversed.

Thirty Million Universes in Sight of Man

The first complete popular picture of those parts of the universe discovered to date with the world's greatest telescope was described at Princeton University on Oct. 29.

The lecture was by Dr. Edwin Hubble, world famous observer on the 100-inch telescope at Mount Wilson, Cal., whose observations have helped Einstein and others to revise their ideas of creation.

Dr. Hubble described the region of the nebulae, 30,000,000 of them, each a separate universe, much like the milky way, which is the "universe" of 200 million light years in diameter to which the earth belongs.

The 100-inch telescope which, he said, could distinguish an arc light on the moon, shows the nebulae lying beyond a vast void surrounding the milky way. It shows them as far out as 300 million light years, which means it would take a ray of light traveling about 186,000 miles a second, about 300,000,000 years to travel to the outermost one. The faintest of the nebulae is about one million times fainter than the faintest star visible to the eye.

These island universes are rushing around in space at about 100 miles a second. But all of those very far out appear to be receding from the earth at speeds increasing with the distance. The farthest one seems to be speeding way at 12,000 miles a second.

After describing what the 100-inch sees Dr. Hubble said:

"The universe must extend beyond these positions and the new region must be much

like the known. But it cannot extend indefinitely.

"The blackening of the night sky and the stability of planetary and stellar systems both argue against the possibility of an infinite universe."

The night sky reference, Dr. Hubble explained, meant that if the universe were infinite and filled with stars like the known portion of space, the starlight probably would light up the night sky.

Deep Radiotherapy in Hypertrophic Prostate

Charles Builbert is of the opinion (*Gazette des Hopitaux*, June 6, 1931) that deep radiotherapy is of benefit in certain cases of enlarged prostate. This must be undertaken, however, before the sclerosing process has set in. Infection in the bladder is a contraindication.—*Uro. & Cut. Rev.*, (Aug.) 1931.

Treatment of Paralysis With the Radiotherm

Hinsie describes (*Wiener Klinische Wochenschrift*, May 29, 1931) his use of the radiotherm for the induction of artificial fever.

With this apparatus he can bring about an artificial fever exactly resembling that of certain malaria.

The method is too new to report clinical results, as he feels that all cases should be observed for at least a year. At present it can only be said that the patients appear to be somewhat improved. Later reports will, of course, follow, but it is interesting to note that an intermittent fever going up to 105 or more every other day can be induced with such certainty and at the same time so easily controlled.

Millikan Believes Cosmic Rays Source of Vast Power

Cosmic rays—beams from a region far beyond the sun and visible stars—are changing and will continue to change the world's ideas on the origin and destiny of the universe, Prof. Robert A. Millikan, American physicist, said here today.

After describing recent discoveries in the power and origin of cosmic rays to prominent scientists who are meeting here, he intimated that the idea of a compact little universe consisting of a sun in the center and planets mov-

ing serenely around it was due for a rude jolt.

Experiments conducted last summer and described to the physicians today, he said, showed that cosmic rays come from a point hundreds of millions of miles beyond the sun and visible stars, and had nothing to do with either.

Furthermore, the energy of cosmic rays, he said, is equal to if not greater than all other radiant energies combined, including those of the sun. This tremendous energy—one cosmic ray is of 786,000,000 volt electrons—comes from a vast field of hydrogen, which is at an incalculable distance beyond the sun, Dr. Millikan said.

"Results of our experiments in cosmic rays seem destined," he said, "to influence profoundly all theories of the origin and destiny of the universe, not only the present ones, but all future theories.

Dr. Millikan contradicted the second law of thermo-dynamics, which states that all forms of energy have a tendency to change into heat and to radiate away from the earth.

"This has been considered by some as conclusive proof for theories of the origin and

destiny of the universe," he said. "But it has not even taken account of the largest source of radiant energy there is.

"The energy carried by cosmic rays throughout the universe is as great as, or perhaps greater, than all other radiant energies taken together."

Heat Waves Show Water Molecules Form in Clumps

New evidence that liquid water molecules form in clumps of two or more has been presented by Prof. Joseph W. Ellis of the University of California at Los Angeles.

The new evidence comes from the way in which infrared or heat rays are absorbed by water. Certain new bands or dark patches observed in the infrared spectrum favor the theory that the simple chemical units of two hydrogen and one oxygen atoms are probably linked in groups or even form a lattice-like structure.

This theory has not been in favor with chemists recently. However, some phenomena observed during the formation of ice lend considerable weight to the idea. — *Science News Letter*, October 17, 1931.

Guido Holzknecht

Radiology has again contributed another martyr to science. Professor Guido Holzknecht one of the world's most distinguished authorities in x-radiology and chief of the x-ray division in the famous General Hospital of Vienna, died on October 30.

He was one of the early pioneers in the field and soon distinguished himself as a fearless and profound investigator of the subject. Through his research and scholarly contributions he materially influenced the trend of modern radiology toward the high recognition that it now enjoys. In the search for the cure of cancer he gradually became a victim of the insidious lethal qualities of the radiation of which he was such a distinguished propounder. It became necessary a year ago to amputate the fingers of his right hand; six months later his hand! three months ago his arm.

In spite of excruciating pain, he showed extraordinary stoical qualities. Indeed, toward the last his colleagues of the Vienna medical association bodily carried him out of his laboratory. The body became weaker in spite of spiritual fortitude.

The Archives has lost one its most distinguished associate editors in his death. Deep condolence is extended to his family.

Physical Therapy in the Modern Hospital

An interesting article on Orthopedic Schools is contained in the (Nov.-Dec.) issue of the *Physiotherapy Review*. Seven schools in Wisconsin have Orthopedic Schools, according to Marguerite M. Lison, Director, Crippled Children's Division, State Department of Public Instruction in Wisconsin.

"Before any steps are taken to establish such a school, a census of crippled children followed by a careful survey is conducted in the county. The county is taken as a unit of study rather than the city. The census is made by the schools, and by health and social agencies. Someone from the Crippled Children's Division of the State Department of Public Instruction then conducts a survey, using as a basis, the information of the census.

"An orthopedic clinic under the auspices of the county medical society and the Wisconsin Association for the Disabled follows the survey. A complete report containing the findings of the survey and the clinic is then made to the city board of education with recommendations that special classes be organized for a definite number of crippled children.

"State aid is granted to cities establishing such classes in order to reimburse them for the excess costs. Cities pay toward this work what it would cost to educate an equal number of normal children in regular schools. This is estimated at \$70 a year per child. A maximum amount of \$300 a year per child is granted as state aid to cover the excess costs.

"These orthopedic schools have also been conducting summer sessions in order that the physiotherapy treatments be continued through eleven months of the year. The state aid has been sufficient to cover also the added cost of the summer session.

"In these schools, the attempt has been made to have the best academic teachers possible. The children are expected to keep up to grade and they do. Many of the children when first enrolled are retarded because of long absences during hospital treatment or during illnesses. Every effort is made to give them individual attention in order to make up the lost time.

"Each child enrolled in the school is there on the recommendation of a physician. A physiotherapist is employed to have supervision of the physical care of these children. Any treatments which are given by that physiotherapist are on the recommendation of each child's physician.

"The young women who are employed in these positions are usually graduates of physical education courses of university grade, and have had post-graduate courses in physiotherapy. Following this training, two or more years' experience in crippled children hospitals, is required. Those employed as assistant physiotherapists have sometimes had less experience, but the same amount of training is required.

"The physiotherapy departments in these orthopedic schools are fairly well equipped. Infra-red and ultraviolet lamps, massage tables, stall bars, head suspension apparatus, walking apparatus, full length mirror, and other equipment are furnished. In some of the larger schools where space permits, hydrotherapy tanks have been installed.

"The children are transported by buses or other means, from their home to the school. As far as possible all stairs are eliminated in the rooms set aside for the special classes and ramps are installed. Railings are placed along the hallways and around the classrooms to aid the child with braces to get about more easily. Cots are furnished so that they may rest during the day. Frequently, the cardiac cases receive two rest periods a day. Luncheon is served the children at noon, and milk is also served them during the morning session. In one school, about one-third of the children are served breakfast, since they come from homes not able to furnish wholesome food.

"These orthopedic schools in the smaller cities especially, have become the real center for all the work in connection with the disabled. Crippled children of pre-school age are brought in to a physiotherapist for assistance in regard to muscle training. Arrangements are made for older boys and girls, who need physiotherapy treatment, and who are en-

rolled in high schools and vocational schools, to come two or three times a week, or daily, if necessary, to the orthopedic school.

"A physiotherapist in an orthopedic school located in a small city is usually the only one in that community who has had specialized training. She is in the position more or less of a pioneer who not only must carry on the actual work, but also must educate the community as to the needs of crippled children. The work of the physiotherapist in most of the orthopedic schools also requires organizing ability. Usually, through the physiotherapy department are made all contacts for the crippled child with the doctor, the hospital, the clinics, the health, and the social agencies.

"In a few years as the appropriation for this work is increased, there will be established orthopedic schools in at least the fourteen cities in the state having over 25,000 population. Under the present law, it is possible for crippled children living in small towns and rural sections and needing ther-

apeutic treatment to attend the orthopedic school. A maximum allowance of \$150 a year is granted to cover the cost of maintenance for such cases who must live away from home. Most of these children boarding in town and attending the orthopedic schools go home over the week-end. If it is found that orthopedic schools in the larger cities are not sufficient to meet the needs of these crippled children living in small towns and rural sections, then later, Wisconsin may establish more of these special classes in even smaller cities.

"Many states are just beginning to realize that very scientific and systematic follow-up care can be provided crippled children through the regular school system, and that such supervision is a responsibility that can no longer be delayed. The progress in the development of this program throughout the United States will depend largely on the number of physiotherapists prepared to undertake the work."

Radium In Treatment of Cancer of Breast

For operable cases Handley feels that the method of Keynes (extensive and prolonged irradiation by buried radium tubes), which has given him good early results, must be admitted to equal competition with ablational methods. When a patient asks him whether he advises operation or treatment by buried radium he usually offers her the choice, adding that if she has the investor's rather than the speculator's temperament she will choose operation combined with selective irradiation. He would not, however, give such freedom of choice to all patients. In patients advanced in years, and with myocardial degeneration or organic disease of the heart, a heavy dose of radium may cause irregular and rapid cardiac action, or pericarditis. A left-sided carcinoma in such a patient can be more safely treated

by operation than by radium. Speaking on the use of diathermy in breast cancer, he says: The method represents not a mere optional variation in technic but a striking improvement. Its advantages depend mainly on three peculiarities of diathermic cutting: (a) It seals most of the small vessels as it cuts them and so minimizes loss of blood; (b) it divides nerves almost without stimulating them and leaves their exposed ends insensitive; (c) during the operation it supplies heat to the body generally and especially to those parts which are exposed for the purposes of the operation. The three principal causes of operative shock, namely, violent nerve impressions, loss of blood and loss of heat, are thus minimized.—*J. A. M. A.*, 95:1622 (November), 1930 ab.



THE STUDENT'S LIBRARY

BOOK REVIEWS

THE NATURE OF DISEASE. Volumes I-III. By *J. E. R. McDonagh*, F.R.C.S., Surgeon, London Lock Hospital, Late Hunterian Professor, Royal College of Surgeons. London: William Heineman, 1924-1927, 1931. Volume I, Pp. 327. Cloth, \$18.00.

On rare occasions research workers in science have formulated the results of their own and the independent observations of other men which, when combined and placed in juxtaposition with each other often have formed contributions of outstanding value. The farther these contributions have been removed from our everyday experiences, the more often have they been regarded with deep suspicion and condemned.

The history of medicine is replete with such occurrences. The memory of its pioneers are heavily laden with the belated honors showered upon them by a repentent world.

The foregoing work of McDonagh suggests that a new and brilliant chapter in contemporary medicine is being written, the framework and fundamentals of which are thus far presented in these three volumes. It is revolutionary in concept and bold in its criticism of modern medical practice. It advances new interpretations regarding the nature of disease and attempts to correlate the existing data in medicine, rather than differentiate it further. The author has extended his studies beyond that of the microscope, the routine methods of laboratory diagnosis and the empirical methods of treating disease. The reader's attention is herein directed to other useful methods in diagnosis, such as the ultramicroscope, the refractometer, the viscosimeter, for interpreting the colloid state of the blood. Elaborate reports have been incorporated, based upon more than twenty years of experimentation, to show that the colloid particles in the blood plasma occupy a place of importance in disease and in health far beyond that which has heretofore been accredited to them. This thesis is slowly but convincingly developed by means of extensive laboratory and clinical work and by studies based upon exhaustive pharma- and chemotherapeutic experimentation. And as result, the work is a challenge to contemporary medical interpretation of disease and its present method of treatment.

The major premise in the present treatise is that the host's general protective substance resides in the colloid protein particles in the blood plasma. In health the colloid particles are shown to be in a disperse phase. In disease they become converted into a condensed state, i.e., a lytic form of condensation (dehydration) and stable form of hydration. Intermediary states may also be formed in which the emphasis may be more toward one phase than the other. Treatment is directed toward breaking up these phases and bringing them back to a disperse or normal state. Since colloid phenomena

is a physico-chemical state, the treatment takes into consideration the electrical structure of chemical and other therapeutic products and their special action on the colloid state mentioned above. The first volume deals with some general considerations of the nature of disease as related to the colloid state of the blood. It discusses the effects of micro-organisms as related to syphilis and other diseases, the rôle of the epithelial and endothelial cells, and leucocytes. It discusses the nature of the conductor and condensor action of microbes and drugs on disease. It discusses the various tests employed by the author in man and rabbit and differentiates the nature of infection and intoxication. Separate chapters are devoted to an interpretation of chemotherapy, blood coagulation, shock, the cerebro-spinal fluid and the rationale of the Wassermann reaction. At the end of each chapter a special summary has been appended, a detail which is of aid in clarifying the many points raised in each particular division of the book.

Volume II, Pp. 434. Cloth. Price \$7.00, net. 1927.

This book embraces a further discussion of the changes the protein particles undergo in disease. The exposition is then expanded to include under separate headings, an interpretation of foregoing effect on the concentration of the water and inorganic salts; the effect on the carbohydrates; the fat; the amino content; the effect on the vascular system; the viscera; cancer; pregnancy and toxemias. A special chapter is also devoted to a further discussion on chemotherapy, organo-therapy and immuno-therapy.

Volume III, Pp. 391. Cloth. Price \$7.00, net. 1931.

This volume is divided into four sections, the first consisting of a general resumé of the author's main thesis, namely, the variations brought about by the changes the protein colloid particles undergo in disease; the second discusses the rather difficult subject of malcoordination and disease; the third, diseases of the nervous system; the fourth, chronic intestinal intoxication.

Of the many impressions experienced by the writer during the period when these volumes were critically read, the outstanding reaction was a feeling that the vast labors and high scholarship incorporated in these many pages was not in vain. It is our impression that the author has pointed out a new and more rational approach to scientific therapy. He has indicated if not entirely proven that the cul-de-sac which modern medicine has gradually drifted into is far from hopeless. We have been fascinated by the glimpses into the new possibilities of a more scientific chemotherapy and a more rational interpretation of disease as advanced in these pages. The average reader must, however, be prepared to bring much patience to the study of this work. It is in truth a difficult subject (colloid

phenomena) for most medical practitioners to understand. But persistence will be rewarded here by the most fascinating interpretation of the nature of disease that has been expatiated upon in recent medical writing. The reviewer urges every progressive medical practitioner to buy these books.

HYDROGEN ION CONCENTRATION OF THE BLOOD IN HEALTH AND DISEASE. By *J. Harold Austin*, Professor of Research Medicine, University of Pennsylvania and *Glenn E. Cullen*, Professor of Biochemistry, Vanderbilt University. Medicine Monographs: VII—Cloth, Price \$2.00 Pp. 75, Baltimore: The Williams and Wilkins Company, 1926.

Hydrogen ion computations as an aid in studying certain metabolic changes in the body in health and disease, have become a recognized procedure. This has resulted from the development of definite methods to determine such computations. The authors have brought together the most important facts in concise form and presented them as simplified as possible for the use of clinicians and laboratory workers in need of this basic information. While the book is apparently not intended as an exhaustive review of the subject, it contains the most important methods employed in technique, developed at the time of publication. In addition, it has a careful digest of the mechanisms of regulation of hydrogen ion concentration in the normal blood, as well as the findings in those diseases which may ordinarily be suspected of contributing to changes in the acid base balance of the blood. The book is, therefore, of great interest and value to those who wish a reference work and a guide, not only to routine, but to further biochemical studies.

DISCOVERING OURSELVES. A View of the Human Mind and How It Works. By *Edward A. Strecker*, A.M., M.D., and *Kenneth E. Appel*, Ph.D., M.D. Cloth. Price, \$2.50. 306 pages, illustrated. New York. The Macmillan Company. 1931.

Although a popular treatise on the subject of psychiatry, this volume, presented as it is by men who are outstanding in their field, is surely a work of authority. The field of psychiatry is indulged in by many who are variously and sometimes inadequately qualified to handle this subject. Consequently, much of the current literature is of little or no value. Most of it is overdone and the facts presented are really few and far between.

Titles of chapters give an insight as to the method of presentation. "How we deceive ourselves," "How the Extrovert meets his daily problems," "Introversion," "Phantasies and Daydreams," "Repression — why and what we forget."

It is suggested that "in viewing life as a whole and not merely as a problem of instincts, that a well-balanced, normal personality must divide its activities into four great fields, viz., Love, Play, Work, and Worship. It is worthy of note in passing that very often people suffering from nervous breakdowns have not shown a proper balance of activities in these four fields. They frequently are deficient in several of them."

We further learn that there are many intellectuals who do not know how to play and live. We are informed of what constitutes the particular type of activity with which one feels contented. These authors firmly believe there is a way to reduce "sources of irritation to a minimum." Do you like to have your day's work planned and does it make you unhappy and "wretched" if you must make your own plans? One is urged to recognize as impossible "the task of seeking creation and originality while working in habitual lines of activity.

This book will undoubtedly be found to be one of the most practical, and conservative, yet authoritative offered in this field.

TREATMENT BY MANIPULATION. A Practical Handbook for the Practitioner and Student. By *A. G. Timbrell Fisher*, M.C., F.R.C.A. (Eng.) Second Edition. Pp. 200 with 62 illustrations. Cloth. Price \$3.50. New York: The Macmillan Company, 1929.

This book has been written by a surgeon with broad experience and a tolerant outlook towards his specialty. His opinion in regard to manipulative surgery is based upon a critical investigation of the subject. He feels that "manipulation when properly performed in suitable cases is a method of treatment of extraordinary value." The author calls attention to the usefulness of manipulation when in the hands of only such medical practitioners as are properly oriented in the method. He considers manipulation of sufficient significance in suitable cases to call attention to its importance as an adjuvant measure to surgical procedure and to point out the dangers of manipulation in unsuitable cases or when performed by inexperienced people. Attention is directed to the usurpation of this special practice by the bone-setter and the osteopath, and their illogical and unscientific position is duly exposed. "Many osteopaths," the author points out, "pay little or no attention to diagnosis, and patients with malignant disease or other serious conditions often waste precious time in such treatment while the condition from which they are suffering is rapidly getting beyond useful medical and surgical intervention. There are many cases recorded where appendicitis and appendix abscess have been treated osteopathically with fatal results—some osteopaths claim to cure acute infectious disease, and hold that these disorders are due to interference with the circulation of the blood by 'subluxated vertebrae'." That the author feels strongly against any sect who have attempted to usurp the scientific administration of manipulation is indicated by the following bold-type statement: "It is a melancholy reflection that the law permits such abominable and dangerous practices."

The present edition consists of ten chapters which carry the reader through the entire theory and scientific practice of treatment by manipulation. The author has contributed a timely and convincing exposition to a subject that has gradually lost caste with the medical profession. He has indicated its place of usefulness in many related surgical conditions and has also pointed out the fallacies associated with its unscientific and ignorant practice. We

predict the continued popularity of this small work because it has been the means of directing attention to our neglect of a useful adjvant in medical practice. We recommend this book to the physical therapist in particular because of the many morbid types of cases that often come to his attention which might be relieved by proper manipulation.

PREPARATION OF SCIENTIFIC AND TECHNICAL PAPERS. By *Sam F. Trelease and Emma Sarepta Yule*. Second Edition, revised and enlarged. Pp. 117. Cloth. Price, \$1.50. Baltimore: The Williams & Wilkins Company. 1930.

The art and mechanics of scientific writing is one of the most neglected portions of the physician's education. Any manual or text that considers this phase of the subject should hold considerable interest for the modern physician. Situations very often arise in the everyday life of the practitioner wherein it becomes both necessary and imperative for him to report certain observations or studies related to his special medical interests. The uninitiated in scientific writing finds this a disagreeable and difficult task, a labor that often becomes incoherent and unbalanced in the very middle of one's literary efforts. Very frequently important observations are either left neglected or are not recorded because inexperience or inferiority complexes developed in the course of misguided attempts at scientific writing. At no time in the history of medicine has medical writing been more fertile in output. On examination it is often found that contributions command the attention and the respect of the critical reader by virtue of possessing a message and a clear, logical, and coherent method of presentation of facts. They are so balanced as to be both attractive and impressive. Many contributions fall by the wayside due to a lack of the foregoing qualities. A time often comes into everyone's life when it becomes highly desirable to translate one's experiences into the printed word. At once one begins to appreciate the necessity of possessing an experience in this direction and to possess some form of special guide to carry one over the rough spots of the mechanics of literary workmanship.

The foregoing volume is a revised and enlarged manual that discusses the preparation of scientific data, and offers suggestions for subject matter and arrangement, corrections and alterations in manu-

script. It offers suggestions and illustrations in regard to preparation of typewritten copy, kinds of type and how to indicate them, use of tenses, correct abbreviations, compiling tables, literature, citations, headings, illustrations, use of footnotes, quotations, proof reading, and table of contents.

The book, in spite of its pocket size, is chuck-full of information of value to the progressive medical practitioner. It is highly recommended to all who are contemplating the preparation of scientific and technical papers.

INJURIES TO JOINTS. By *Sir Robert Jones*. Bart, K.B.E., C.B., F.A.C.S. (U. S. A.) Emeritus President, British Orthopedic Association; President, International Orthopedic Association; Consulting Orthopedic Surgeon, St. Thomas Hospital, London, etc. Third revised Edition. Pp. 195. Cloth. Price, \$2.00. London and New York: Humphrey Milford (Oxford University Press). 1930.

The third revised edition of this pocket sized book is maintaining its popular hold on the medical profession as exemplified by the unusual number of reprintings that this volume has passed through. There is much in its pages to warrant its popular hold on the profession. It discusses the subject of injuries to joints in a concise manner. It is free from padding, and presents the salient facts of the author's vast experiences in a coherent and authoritative manner. It is a timely contribution of practical value to the orthopedist and to the general practitioner. It deals with such everyday subjects as strains, sprains, dislocations and fractures about the joint. It discusses the advantages and the practical usefulness of bandaging, massage and movement; the management of pain and stiffness in relation to diagnosis and treatment. Consideration is also given to the treatment of contracted scar tissue and limitation of motion. The author has, in spite of the abbreviated style utilized in these pages, presented one of the clearest and down-to-date expositions on joint injuries. Although the discussion in many places is suggestive of the outline form, yet there is sufficient detail to round out the various topics to the satisfaction of the reader. It is indeed one of the most practical contributions to the subject. Neither the general practitioner nor the specialist can afford to be without it. The book is highly recommended.



INTERNATIONAL ABSTRACTS

A New Electrolyte for Ionization. E. Gowland.

Brit. J. of Phys. Med., 2:36 (May) 1931.

The author reports the use of trichlorophenylmethyliodo-salicyl (British T. C. P.) as an electrolyte in the ionization treatment of chronic arthritis. This preparation contains the chlorine, iodine and salicylic radicles in a "peculiarly assimilable form" readily introduced into the tissues. The undiluted solution is used on the electro-negative pad and applied as usual to the afflicted joint; the electro-positive pad is soaked in plain water or normal saline. Treatments are given on alternate days or twice a week, beginning with a 10 ma. current for twenty minutes and increasing up to 30 to 40 ma.; if this dose causes discomfort it should be reduced. The usual course consists of twelve treatments, which may be repeated after an interval of about a week. This treatment has always relieved the pain and swelling of the joints in the cases treated by the author.

Radiographic Evidence of Mastoid Pathology. Richard A. Rendich, M.D.

Med. Times and L. I. M. J., 59:319 (Sept.) 1931.

1. To be of value, the radiograph must demonstrate the entire mastoid in finest detail.

2. The Roentgen examination accurately depicts the anatomy of the mastoid.

3. With a satisfactory roentgenogram the presence of inflammatory products and destructive changes of the adult mastoid can be determined, while in the infantile mastoid the information obtained may be limited to the presence and amount of inflammatory products.

4. Chronic sclerosis of the mastoid is readily recognized but no evidence may be had of an associated acute exacerbation of a chronic otitis media.

5. The mastoid roentgenogram must be considered as an aid in deciding upon surgical intervention and not as the deciding factor except in the atypical case.

Protection in the After Care of Poliomyelitis. Walter Truslow, M.D.

Med. Times and L. I. M. J., 59:307 (Sept.) 1931.

1. Though poliomyelitis is one of the most dreaded of the diseases of childhood and early adult life, the fear of it is exaggerated. This fear is due to ignorance. It is not realized that Nature tends toward recovery and that skilled care reduces the paralysis to a minimum, minimizes deformity and carries the patient through to a maximum of efficiency.

2. To conserve muscle tone, to aid restoration of muscle power and to prevent deformity, protection is the underlying principle of procedure.

3. Methods of bracing and other forms of protection are discussed.

4. Protection leads gradually into progressive muscle stimulation.

5. Muscle re-education is the most valuable form of physiotherapy.

6. Deformity delays restoration of muscle power, is an added disability and must be prevented or minimized.

7. Even when there is residual paralysis, there is hope of much added efficiency by carefully selected reconstructive operating.

Der Rheumatische Schiefhals. (Rheumatic torticollis). Alfred Saxl.

Ztschr. f. orthop. Chir., 52:4:603-613 (March) 1930.

The therapy of rheumatic wry neck comprises first action on the rheumatic myositis as such and second, measures against the inclination of the head if it lasts longer. Apart from the potentially necessary prescription of antirheumatic or analgesic remedies, the sovereign mode of treatment is massage. The prescription, too, of various embrocations often acts rather by the massage connected with them than by quality of the drug. The massage of the sick muscles can set in at once, the affection still being fresh. First one begins with gentle effleurage, then, after the acute condition has cleared up, one proceeds to more energetic effleurage and petrissage of the affected muscles. Massage is helped by thermo and electrotherapy, the latter being given in the form of faradic or galvanic current. Hot air therapy is also recommended. Together with the regression of the rheumatic myositis associated with rheumatic torticollis also disappears the vicious posture of the head. If this is not always the case, the therapeutic measures are to be supplemented by a merely mechanical support of the inclined head. For this purpose a supporting collar is made of cotton rollers, wrapped round the neck in several layers and fastened by a bandage. Such a collar can also be made of soft towels which are first folded up lengthwise in several layers and rolled up into a roller bandage and then wrapped round the neck in several layers. These supporting bandages exert a relaxing action on the diseased, distended muscles and moreover influence favorably the myositis as such through the uniform warmth of the bandage.

Zur Behandlung Des Leukaemischen Priapismus. (Contribution to treatment of leucemic priapism). R. Stern.

Fortschr. d. Ther., 5:349-350, 1929.

The author reports a cure due to roentgen ray irradiation in a case of leucemic priapism of the most excruciating kind. After using in vain cool

baths, pantopon, bromural, the yard was irradiated while its gland was protected. Within 12 days the patient underwent 3 irradiations with 20, 30 and 30 per cent of skin unit dose and filtration by 0.5 zinc and 2.5 aluminum. As soon as 3 days after the first exposure the patient stated the painful tension in the penis to abate; after the last exposure there was a frank relaxation of the penis, which was found to be quite normal ten days after the close of treatment.

An Effect of Light on Blair Bell's Colloidal Lead.
W. J. Penfold, M.B., Ch.M. (Edinburgh) and Jas. Sutherland.

The Med. J. of Australia, (June 7) 1931.

1. Gelatine protected colloidal lead or silver particles can be caused to settle on the walls of the containing chamber by the action of light, chiefly on the surface near the source of light. The silver colloid is much more readily affected than lead.

2. Orange-yellow light (5,400 to 7,000 Ångström units) is not active in this reaction, while light of short wave length is exceedingly so.

3. Light which has passed through a Becker screen which cuts out the great bulk of visible light and lets through the ultraviolet light is active in the reaction.

4. The cutting out of the heat rays does not greatly, if at all, delay the reaction.

5. Emulsions of staphylococci were not affected like lead or silver emulsions.

6. The settled lead particles are larger than those moving and permit of easy measurement.

Radiation Therapy in Menstrual Headaches.
Charles L. Martin, M.D.

Texas J. of Med., (August) 1930.

1. One type of menstrual headache usually absent during pregnancy and usually relieved by the menopause, appears to be due to some improper relationship between the secretions of the pituitary and the ovary.

2. An artificial menopause produced in the latter years of menstrual life brings about a cure or marked relief in many cases.

3. In younger women, gland extracts offer some hope of relief but castration is contraindicated. Mild glandular radiation, when properly understood, may prove of some value in these cases.

The Action of Radiation from Radium Needles on Nerves. Daphne L. Goulston, B.Sc.

The Med. J. of Australia, 2:20 (November 15), 1930.

PART I

1. Two effects follow the application of γ rays from radium to nerves. These are a local atrophy at the site of radiation and secondary Wallerian degeneration in the nerve fibres below the atrophied region. The local atrophy is shown by disintegration of the myelin into droplets with subsequent gradual disappearance of the fatty droplets. The axis cylinder appears to be destroyed somewhat later than the splitting up of the myelin. The nuclei of the neurilemma becomes less distinct. The secondary

Wallerian degeneration appears to be typical in its characters.

2. A certain period of from twenty to thirty days must elapse before any change can be noted in the nerve. The changes seen after this period elapsed are local atrophy at the site of radiation together with secondary Wallerian degeneration in the same nerve fibre peripherally, the central end remaining normal.

3. Radiations from three milligrammes of radium applied for a distance of one centimetre along the sciatic nerve of rats and guinea-pigs for three to ten days give rise to local atrophy and secondary Wallerian degeneration, but all the nerve fibres are not affected, normal fibres being still present. When the needle is applied for over thirty-five days, it produces local atrophy and secondary Wallerian degeneration in all the fibres.

5. The length of the atrophic segment measures three to four millimetres or nine to ten millimetres, according to the active length of the needle, either one or two centimetres respectively.

6. There is a minimal dosage below which no histological changes are induced in the nerve. This minimal dose is about ten milligramme-days.

7. There were no signs of regeneration in any of these nerves, even up to sixty-three days.

PART II

1. With small doses of radiation degeneration of the myelin sheath only is observed, using three separate methods of staining, namely, silver nitrate, osmic acid and haematoxylin. No degeneration of the axone was observed even though the experimental period was prolonged to six months.

2. With sufficient dosage and experimental period degeneration of the axone does occur, local atrophy and secondary Wallerian degeneration again taking place.

3. Degeneration of the axone can be brought about by primary β and γ rays only, the soft secondary rays having been eliminated.

4. No statement can be made at present concerning the regenerative effect of radiation.

5. Great proliferation of the nuclei of the neurilemma sheath occurs at the site of radiation.

The Management of Chronic Pelvic Infections in Women. Luther O. Baumgardner, M.D.

Ohio State Medical Journal, (January) 1931.

1. Of 142 cases of chronic pelvic infection 106 or 74.5 per cent were treated.

2. Of the 106 treated cases 45 or 42.5 per cent were cured; 51 or 48 per cent were very much improved; and only 10 or 9.5 per cent were unimproved.

3. Protein therapy in the form of sterilized milk or Aolan injections is a very valuable method in treating these patients.

4. The electric cautery is a sure and efficient method for curing the lesions of the cervix in these cases.

5. Major surgical procedures are required in the management of some of these cases; in this series about 19 per cent.

6. Results would be better if the husbands of

these women could be cured of their chronic gonorrhea.

Tuberculosis of the Cervical Lymph Glands.
W. B. Chapman, M.D.

Am. J. Phys. Therapy, 8:153, (Sept.), 1931.

In concluding his series of articles on tuberculosis of the cervical lymph glands Chapman wished to again call attention to the advantage of physiotherapy over other forms of applied treatment.

1. The condition is eliminated by a natural process and without pain or discomfort to the patient.

2. The process most usually disappears by absorption and requires no surgical procedure.

3. In late cases, where necrosis and sloughing has already taken place, it is possible to sterilize the field and limit the infection more quickly and effectively than by any other method of treatment.

4. It shortens the duration of the disease.

5. Radical surgery is eliminated.

6. Scarring is prevented or reduced to a minimum.

7. The recovery is complete.

It is hoped that with a better understanding of the indications and advantages of physical measures by physicians and its application in the early stages of such conditions as cervical tuberculosis that all indications for surgery will be eliminated and many thousands of sufferers will be restored to health and saved the humiliation of carrying unsightly scars or discharging sinuses throughout life.

Rickets. **W. G. Klugh, M.D.**

Tri-State M. J., 3:688, (Sept.), 1931.

According to the author, viosterol and irradiation of the body with ultraviolet light are our most potent weapons against rickets and may be depended on to bring about a cure. Viosterol (250 D) should be given in a dose of 15 to 20 drops daily. It has been noted by several observers that there is practically no danger of giving large doses in the presence of rickets. Hypercalcemia and evidence of intoxication are more apt to be noticed when rickets is absent or large doses continued after rickets is cured. At all times, however, there is a wide margin of safety. It has been suggested, and perhaps wisely so, by Gobel and Claman, that the dosage be given under observation, clinically, serologically and roentgenologically. An occasional determination of the inorganic blood phosphorus and x-ray observation will not be amiss, serving as a guide to decrease or increase dosage. Should a child lose its appetite or develop some diarrhea during viosterol administration it is advisable to discontinue its use temporarily, at least. Viosterol will usually bring about a cure in four to six weeks.

Ultraviolet rays may be obtained from the carbon arc or mercury vapor light. Either may be used with confidence in their ability to bring about a cure of rickets, provided the technic is correct—sun baths may be used to supplement the above treatment.

Children that have developed ricket of moderate severity should be guarded against too much standing or long sitting, as deformities may be lessened

by taking this precaution. Massage, passive exercise and salt baths may be utilized with benefit. The use of braces should in general be avoided unless the deformity is such that it is interfering with the child's exercise. Usually when a brace is applied a child will not take its exercise as before, consequently the general musculature suffers.

Cod liver oil may be used as a curative agent, however, irradiation with ultraviolet light or Viosterol is so much more potent until it will probably be used in the future as a supplement to other methods of treatment.

Cancer In and About the Mouth, Treated with Irradiation by the European Method. **Charles L. Martin, M.D., and James M. Martin, M.D.**

Texas State J. of M., 27:286, (August), 1931.

1. The number of cures in cancer of the lip produced by efficient irradiation equals that produced by surgery and the cosmetic results are much better.

2. The European method of radium needle implantation in intraoral cancer produces rapid disappearance of the primary lesions without painful reactions, and since it restores the structures to a practically normal condition, is superior to any surgical procedure.

3. Combined irradiation methods are superior to dissection in treating secondary malignant lymph nodes in the neck, except where the glands are unilateral and the malignancy has not ruptured through the capsules, and even in these cases irradiation is a valuable adjunct.

Tonic Medication in Dermatology. Principles, Experimental Confirmation and Clinical Application. **Loren W. Shaffer, M.D.**

Archives of Dermatology, 23:2, 1931.

The general principles of ionization in therapy are reviewed, as well as the experimental work on this subject. It is generally accepted that, in life, drugs cannot be driven deeper than the subcutaneous tissue.

Experiments performed with the use of physical solutions showed that:

The rate of penetration of ions varies directly as the voltage.

Various ions travel at different speeds.

The rate of penetration in physical solutions and tissue is surprisingly slow.

An endeavor has been made to show the path followed by drugs under the influence of the galvanic current in their penetration of the epidermis. The assumption that the sweat ducts are important portals of entry has been strengthened, but not proved. A portion of the current may penetrate directly through the epidermis to the nearest papillae.

The literature has been reviewed for clinical reports of the use of ionization in dermatology. It has been used in practically all types of chronic infections of the skin.

Five cases of coccigenic syphilis have been reported, in four of which a rather prompt and satisfactory response has been obtained by treatment

with ionization of compound solution of iodine. The cases have not been observed long enough to ensure against relapse. In the fifth, a recent case, treatment is still being given.

In two cases of dermatitis papillaris capillitii, the response could not be classed as satisfactory.

In more than half of six cases of pruritus ani and two of pruritus vulvae, from excellent to good results were secured.

Two cases of verruca failed to respond.

Two cases of lupus erythematosus failed to respond to treatment by ionization of quinine, although one is seemingly responding well to that by ionization of gold and sodium thiosulphate.

Satisfactory anesthesia for dermatologic surgical procedures may be secured by the use of ionization with cocaine, but persistent erythema and pigmentation render the method of little practical value.

The question of the mode of action of ionization and its indications in dermatology is discussed. The action of the current itself is of as much, and in some conditions of more value than that of the drugs used.

Irradiation of Carcinoma of the Cervix Uteri.
Harry H. Bowing, M.D., and Robert E. Fricke, M.D.

Minnesota Medicine, (March) 1931.

The author's summary of this interesting article follows:

In this rapid review of methods and results in the largest radiologic clinics, we have found great variation in method with fairly uniform results. With radium, treatments may be given in two hours, and also in a month of constant irradiation, with all gradations between these extremes. The method at The Mayo Clinic lies between the massive dose and the fractional dose and embodies some of the advantages of each. In many parts of Germany roentgen treatment alone is used successfully; the results are not duplicated in this country. In four large clinics only (Baltimore, Stockholm, Cleveland, and Boston) radium is used without the help of roentgen rays.

In July, 1924, Greenough published the Report of the Committee on Treatment of Malignant Diseases with Radium and Roentgen Rays. Greenough's summary contained the information that in early and favorable cases of carcinoma of the cervix the choice between radium and operation is an open one. In advanced cases, the value of radium as a palliative measure is beyond dispute. In cases recurrent after hysterectomy, and in cases of carcinoma of the cervical stump, radium is the treatment of choice.

It must be remembered that either form of treatment, irradiation or operation, can effect cures only if the disease is local; if distant metastasis has occurred, surgery has nothing to offer, whereas irradiation may yield considerable palliation.

The Conservative Management of Nasal Accessory Sinus Disease. **A. R. Hollender, M.D.**

Tri State Medical Journal, August, 1931.

The summary and conclusions of the author are:

1. The theory that chronic infection of the

sinuses is primarily due to bacteria, poor drainage and aeration should be modified to include the underlying factors of deficiency in vitamins, allergy and endocrine imbalance.

2. There are definite indications for radical sinus surgery, but, in general, rhinologists are now exercising greater efforts in attempting to restore normal function of the nasal cavities by conservative therapy.

3. Acute sinusitis requires general as well as local care.

4. Prophylaxis of acute nasal accessory sinus disease is the problem of the general practitioner; that of chronic involvement, the problem of the rhinologist.

5. A conservative surgical measure which has accomplished a great deal in chronic infection of the maxillary sinus is the window resection.

6. Suction, irrigation, displacement irrigation, and nasal tamponade are well recognized procedures with which to conservatively deal with nasal sinus disease.

7. Infrared radiation, diathermy and zinc ionization are modern additions which have fortified the older procedures.

8. In the final analysis, desensitization, vaccines, endocrine therapy and a diet emphasizing vitamins are important general measures which must supplement local drainage to effect the most satisfactory results.

9. When conservative management fails, radical surgery is definitely indicated.

The Status of Biophysics in Modern Medical Practice. **E. N. Kime, M.D.**

Jour. Indiana State Med. Assn., 24:8, (August 15) 1931.

1. Widespread interest exists among both physicians and their patients in the practical application of biophysical agencies administering light and heat and electrogymnastic exercise.

2. A dearth of knowledge exists which can be corrected only by the study of the fundamental principles of medical biophysics—which should be taught in the premedical schools along with academic mathematical physics.

3. The biophysical agencies, light and heat, are physiological antagonists. They are properly balanced in the solar spectrum—but when administered alone their biophysical action, whether actinic, vasoconstrictive and catabolic—or whether thermal, vasodilative and anabolic—should be remembered.

4. Physical agencies, together with their respective chemical synergists, exert a profound influence upon cellular metabolism, by modifying the permeability of the semipermeable membranes. Actinic agencies decrease permeability—thermal agencies increase permeability.

5. A state of dynamic equilibrium is the normal functional state of every living tissue—including skeletal muscle. "Log-like" rest is unphysiological. In post-traumatic states, peripheral nerve palsy, muscle dystrophy and anterior poliomyelitis, electrogymnastic exercises maintaining muscle tone and nutrition should be initiated under expert medical supervision at the earliest possible moment.

6. Tissues which have undergone irreversible changes to neoplasm or infection, may most efficiently be ablated by destructive heat—best exhibited in the form of electrosurgery—or surgical diathermy.

Electro-Physiotherapy in Heart Disease. Dr. A. Laqueur.

Brit. J. of Phys. Med., 6:1:5.

It should be pointed out expressly, that serious affections of the heart muscle, with frequent attacks of angina pectoris and signs of grave myocardial lesions (e.g., constantly irregular pulse), are contraindications for cardiac diathermy. The heat may cause further and dangerous myocardial lesions, and must be avoided in all serious cardiac affections, e.g., bronchial asthma or pneumonia. In the light or slightly serious cases of angina pectoris and stenocardia, which present no other losses of compensation and average hypertension (about 140-180 mm. Hg.) cautious diathermy of the cardiac region may effect considerable and long lasting improvement. Begin with treatments of ten minutes duration leading up to not over fifteen minutes, and passing a current of not over one milliampere.

Failure of Irradiated Ergosterol to Relieve Parathyroid Tetany. Thomas Findley, Jr., M.D.

Annals of Int. Med., 4:9, (March) 1931.

A case of parathyroid tetany associated with epilepsy and acute psychosis is reported.

The theories of the action of irradiated ergosterol are briefly described and evidence is presented to show that one of them which supposes that vitamin D increases calcium absorption from the intestinal tract is not supported.

The mechanism by which irradiated ergosterol acts is not known. It seems highly improbable that it stimulates the parathyroid glands to increased secretory activity.

Large doses of viosterol alone are insufficient treatment for parathyroid tetany, and it is thought that even if it be combined with calcium therapy, the viosterol is an unimportant factor.

The Effect of Irradiated Ergosterol on the Thrombocytes and the Coagulation of the Blood. A. A. Phillips, M.D., D. F. Robertson, M.D., W. C. Corson, M.D., and G. F. Irwin, M.D.

Annals of Int. Med., 4:9, (March), 1931.

The tables and graphs are self-explanatory, and but one conclusion is drawn, namely, that irradiated ergosterol is responsible for the increase in the thrombocytes and the decrease in the coagulation time in this series of experiments. Of course there is the possibility that non-irradiated ergosterol or other sterols will produce a like effect. This problem is now being studied and will be reported in the near future.

Further studies on the clinical dosage and its effect on the thrombocytes and coagulation time in healthy and pathological humans are now being made by Dr. L. D. Thompson and his co-workers in the Department of Medicine of Washington University, and will be reported soon.

Diathermy Treatment in Impotency. A New Method. Joseph Echtman, M.D.

The Urologic and Cutaneous Review, 34:11, (November) 1930.

The author reports a case in which the prosthetic methods did not improve the condition. A new method is suggested which consists in the diathermination of the testicles by placing the active mesh electrode on the scrotum (therefore the new method is referred to as "scrotal") and the large indifferent electrode is placed under the buttocks of the patient, who is lying on his back. Many patients were treated by the author with very encouraging results though he also had failures. The new method, however, was of service in a number of cases where other procedures had failed.

Die Volldosen — Und Die Fraktionierte Bestrahlungs — Methode Der Karzinome. (Full and Fractional Dosage Methods in Cancer Radiation). Leopold Freund.

Acta Radiologica, 12:315 (September) 1931.

The treatment by divided doses developed in Vienna from the attempt to avoid the unpleasant side-effects of large doses given shortly after one another. In the form of smaller doses, suitably interspersed, the roentgen treatment proved not only less dangerous, but effective in a number of ways. The reaction to the divided dosage is not of the same character as the reaction to the full doses. That the treatment of carcinomas by divided doses in certain cases gives better results than the full-dose treatment is ascribed by the author not only to an increased selective action and to the possibility of administering by that method a greater total of irradiation, but also to the circumstance that it permits of the pathological process being kept for a longer time continually in a condition of moderate reaction to the rays, thereby enabling the destruction to take place more gradually.

With regard to the general indications for roentgen- and radium treatment of neoplasms, the author holds the determining factors to be: 1) the depth at which the growth is located, 2) the degree of its radiosensitivity, and 3) the speed with which it is growing.

If the tumor be of rapid growth and highly radiosensitive, an intensive, full deep-dose should be given in one single application, leaving all other considerations aside; in order to counteract, by the quickest and completest possible destruction of the cancer tissue, and regardless of any side-effects, the threatening danger to the patient's life.

Neoplasms of only slowly progressive growth, not too radiosensitive nor too deeply extending, may be treated by a frequent succession, at short intervals, of comparatively feeble and protracted irradiation doses, none of them below the minimum of the therapeutically active dose.

Successive impacts (radiation doses) of greater intensity and longer duration, but with greater intervals between, will be a matter for consideration in cases where a more deeply extending—though not more strongly radiosensitive or too rapidly growing—neoplasm makes it desirable to take advantage not only of the more highly destructive

action of a stronger dose, but also of the more selective effect of a more protracted action of the latter.

With regard to the technical side of the divided-dose treatment, the author points to the existing publications, to the directions given in which he would, however, accord only the value of general exemplification, the single parts of the method having to be regulated—following Schwarzschild's rule—according to the demands of each individual case. Also the regard to the cutaneous reaction as biological index is touched upon.

As a means of further improving the results of treatment of cancer, the author recommends, in any cases where such is if only halfways possible, to use the treatment practiced by him since 1904; viz. the surgical extirpation, as radical as possible, of the growth, staunching of the blood, and roentgen- or radium treatment of the open, unsutured wound.

The Treatment of Boils and Carbuncles by Roentgen Rays. Eugene T. Leddy, M.D., and S. Archibald Morton, M.D.

Minn. Med., 13:8, (August) 1930.

The usual methods of treatment are reviewed. In spite of the fact that roentgen rays have been used successfully in the treatment of boils and carbuncles for more than twenty years, the value of the method apparently is not appreciated by most physicians. The authors contend that the treatment of these lesions by roentgen rays, although not always efficacious, is superior to the methods generally used.

"It is well known that the lymphocytes are the most radiosensitive cells in the body, and that destruction of lymphocytes is one of the first effects noted following exposure to moderate doses of radiation. It is important, in this connection, to emphasize that in treating inflammatory lesions, large doses of roentgen rays are neither necessary nor advisable because of the great sensitivity of these inflammatory cells.

"The mechanism of the effect is not perfectly understood. A plausible explanation is this: Since it is known that small round cells act as a defense against pyogenic infection, and that lymphocytes are extremely sensitive to radiation, it is fair to assume that when these cells in an inflammatory lesion are destroyed, the protective substances in them are liberated in larger amounts for immediate defense than is the case when they remain intact. This theory at least is in accord with known clinical facts.

"There are several advantages in the use of roentgen rays in these conditions. The treatment can do no harm. It is painless and inexpensive, does not consume much time of either the patient or the physician, and is almost always effective. Another advantage is that in the early stages in which other methods offer least, roentgen rays are of most value. If a patient comes with an indurated swelling, suggesting an early boil, the physician has nothing that he can use that will abort the disease. If the indurated type of lesion is treated with roentgen rays, not only are all dressings and infected discharges obviated, but rapid, marked bene-

fit should ensue in more than 80 per cent of the cases, and the lesions should heal without scars.

"The disadvantage of this form of treatment is that the facilities for giving it are available only in the larger centers. However, a boil, and particularly a carbuncle, is a debilitating enough condition to warrant the sending of the patient to a place where he can be adequately treated by a method that gives him the best chance for prompt relief."

Postoperative Vicarious Chronic Menorrhagia Cured by X-ray. Victor C. Pedersen, M. D.

Med. Times and L. I. M. J., 59:353 (Sept.), 1931.

1. The duration of this case with maintenance of health during 12 years is unique. One would expect at least neurasthenia.

2. The recovery power of the patient exemplified by five operations was a good foundation for success of any treatment.

3. A laparotomy on this patient at the present time could not be justified without modern nonoperative measures previously.

4. The time cannot be far distant when the public will demand reasonable trial of nonoperative physical measures before surgery is resorted to.

5. Physical therapy resembles all other measures in not being a cure-all. Neither is it a cure-nothing. The difficulty, which experience will remove, is to distinguish the operative from the nonoperative cases. Many borderline cases, like this one, belong in the physical therapeutic group.

6. There is no doubt in my mind but that operators, including myself, must learn this distinction and thus save patients the dangers and occasionally indifferent if not disabling results of surgery.

7. Hospital statistics show that about 80 per cent of all operations are classed as operations of "election," not of "emergency." In this case operations 1, 2 and 3, while elective, were necessary. Operations 4 and 5 were emergencies.

8. The present condition of this patient was that of election again, which permits nonoperative physical measures to reach their limit of relief or register their failure before another laparotomy is undertaken.

About February 15th, 1931, over the telephone the patient reported perfect health since cessation of treatment June 3rd, 1929—about 21 months previously.

Therapeutic Irradiation of the Ovaries. A. C. Siefert, M.D.

Cal. and West. Med., 35:290 (Oct.), 1931.

1. Radiation therapy directed to the ovaries with a view of the temporary or permanent elimination of their function is safe and economical in many gynecological and general diseases.

2. Roentgen or radium radiation is the treatment of choice in benign menorrhagia, painful menstruation and menses associated with severe systemic symptoms. It may be also termed the treatment of choice in simple uncomplicated or intramural

fibromyomata of the uterus not exceeding the size of a three months' pregnancy. Larger myomata may be treated with the roentgen ray with excellent hopes of success. It is especially indicated where such tumors are complicated by serious renal, cardiovascular, or pulmonary diseases.

3. Of the two agents used in radiation therapy the roentgen ray is the safest and most economical to the patient. Radium is most valuable when the immediate cessation of a uterine hemorrhage is imperative, or when a diagnostic curettage is to be done.

4. The one general and absolute contraindication to all radiation treatment in benign conditions is pregnancy. There are also special and relative contraindications to radiation treatment, especially in the treatment of fibromyoma uteri which I shall not repeat here.

5. In treating youthful patients the ovarian function need not be permanently abolished, and this end may be accomplished by careful and accurate dosimetry (dosimeter in vagina, preferably).

6. The question of damage to the offspring arising from the fertilization of a radiated ovum has not yet been settled for the human. Personally, I think as a rule women much below forty years should be excluded from radiation therapy whenever possible.

7. Radiation therapy does not exclude subsequent surgery nor render it, as a rule, more difficult.

8. Radium will stop uterine hemorrhage within twenty-four hours even in small doses, the latter by direct action on the endometrium. This is not equivalent to action on the ovary of larger doses.

9. The number of authors is increasing who report favorable results from roentgen irradiation of the ovaries when used in chronic infectious disease of the genital tract.

10. Cessation of the menstrual function through irradiation of the ovaries has a valuable therapeutic effect in carcinoma of the breast in Graves' disease and in tuberculosis of the lungs.

A New Oxygen Therapy Apparatus. T. A. Taylor, M.D.

Texas State J. of M., 27:436, (Oct.), 1931.

The advantage of the apparatus described may be mentioned briefly, as follows:

1. The apparatus is easily portable, because it is compact in one unit. It is easily conveyed in the hospital, as the entire apparatus is supported on one carriage.

2. The air and oxygen under the tent are cooled and circulated by convection, eliminating the necessity of any kind of machinery for air cooling and circulation.

3. The apparatus can be used as a device for regulating the temperature and moisture of the air under the tent, while at intervals the oxygen may be discontinued.

4. It can be operated successfully with or without the use of soda lime.

5. The oxygen is admitted to the control box through a single rubber tube, and constant observation is not required.

6. The ice and the soda lime screen can be placed in the control box without disturbing the patient or discontinuing the flow of the oxygen.

7. The apparatus gives a very efficient and accurate method of controlling the temperature under the tent by the use of dampers connected with the control box.

8. The humidity under the tent is controlled and regulated by the ice chamber and the water in the drip pan.

9. The carbon dioxide attachment may be used when higher concentrations of this gas may be needed in atelectasis cases for lung ventilation and drainage.

10. Finally, it is safe and economical in operation.

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Of Archives of Physical Therapy, X-Ray, Radium published Monthly at Chicago, Ill., for October 1, 1931.

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Before me, a Notary Public in and for the State and county aforesaid, personally appeared Disraeli Kobak, M.D., who, having been duly sworn according to law, deposes and says that he is the Editor of the Archives of Physical Therapy, X-Ray, Radium and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management (and if a daily paper, the circulation), etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

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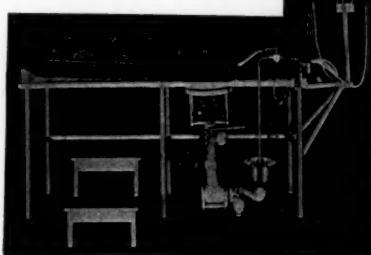
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